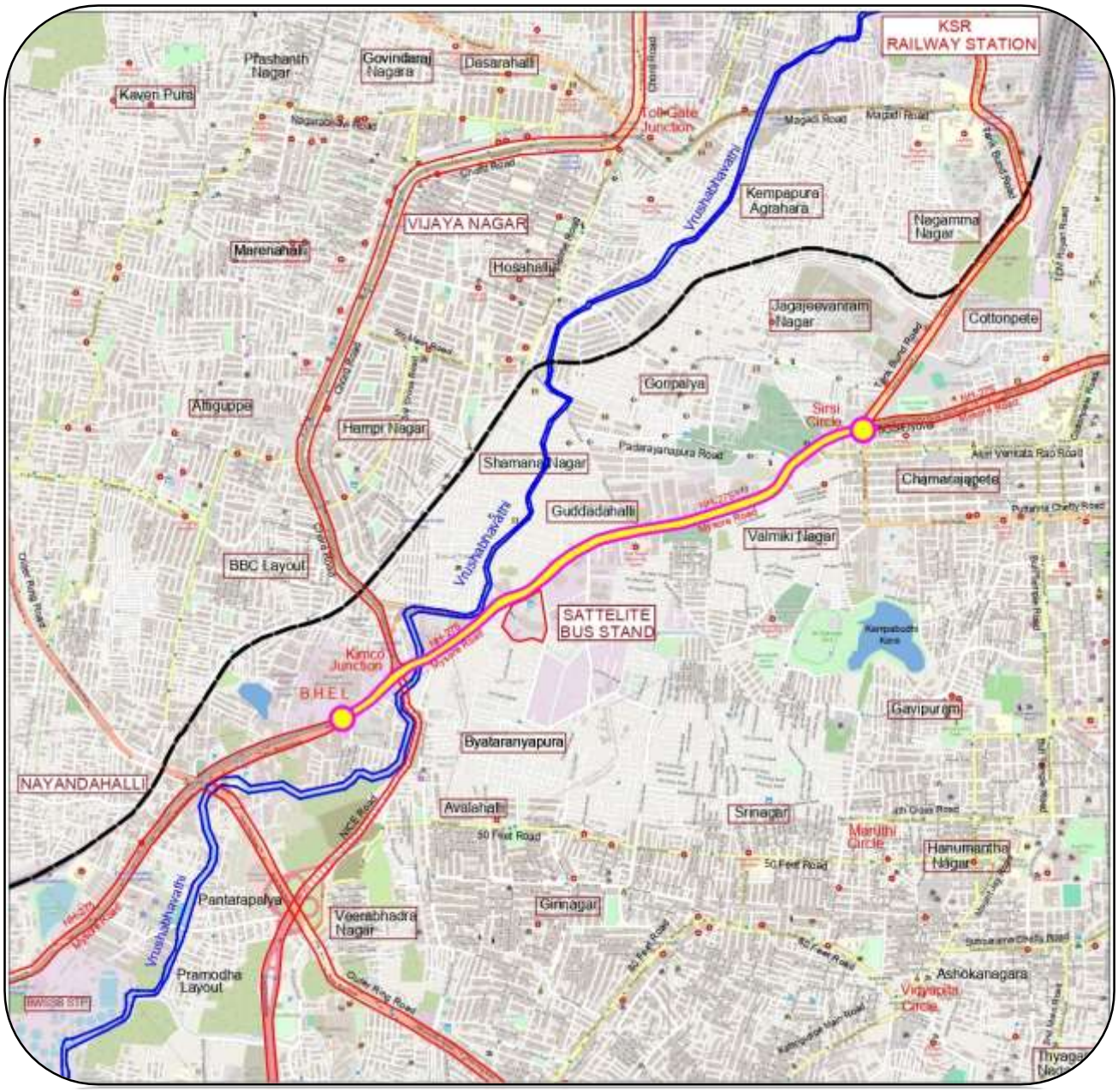
BENGALURU SMART INFRASTRUCTURE LIMITED (B – SMILE)
Office of the Chief Engineer-03
#30/1, Thimmaiah Road, Miller Tank Bund Area,
Vasanthnagar, Bengaluru - 560052.

Construction of Proposed Elevated Corridor from Sirsi Circle to Nayandahalli on Mysuru Road



Scope of Work and Design Criteria for Contract
(To be referred along with tender document/RFP)

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SCOPE OF WORK AND DESIGN CRITERIA FOR CONTRACT

(To be referred along with tender document/RFP)

1.0 Scope of Work

1.1 General

The Government of Karnataka is according high priority to the development of core urban infrastructure in Bengaluru, considering the city's significant contribution to the State economy and its rapidly increasing transportation demand. In this regard, the Government has established a Special Purpose Vehicle, Bengaluru Smart Infrastructure Limited (B-SMILE), for effective utilisation of Government grants towards implementation of major infrastructure projects on priority basis. As part of this initiative, the Government has accorded in-principle approval for development of approximately 120 km of elevated corridors, flyovers and grade separators across Bengaluru city with an initial allocation of Rs. 7,000 Crores to facilitate seamless and uninterrupted urban mobility.

Under this programme, B-SMILE proposes to implement an elevated corridor from Sirsi Circle to Nayandahalli on Mysuru Road (Length 5.2kms) in Bengaluru city under EPC Mode on Lumpsum, Trunkey with allowable Price escalation using UHPFRC based structures. The proposed corridor is envisaged to improve traffic efficiency, reduce travel time and enhance connectivity between the eastern and southern parts of Bengaluru.

The proposed elevated corridor is planned to be executed using advanced construction technologies including slim-type superstructure systems with Ultra High Performance Fibre Reinforced Concrete (UHPFRC) girders, enabling longer spans, reduced structural depth, faster construction and minimal disruption to existing traffic during implementation.

In this context, B-SMILE invites bids from eligible Tenderers on an Engineering, Procurement and Construction (EPC) basis, adopting the Tenderer's own design approach in accordance with the key parameters specified by B-SMILE. Provision for one Alternate Proposal is permitted, subject to compliance with relevant Indian and International Standards and approval by B-SMILE. The location and extent of the project corridor are described in the subsequent sections of the tender document.

Tenderers shall submit only one Proposal. Additional Proposal / s shall result in the Disqualification of the Tenderer.

The Turnkey Contract based on the Contractor's own design shall include, but not be limited to, carrying out Topographical Surveys, Geotechnical Investigations, utility investigations, traffic studies, and all other ancillary investigations and works necessary for the planning, design, engineering, execution, testing, commissioning, and completion of the Project. The scope shall further include provision of all labour, materials, casting yards, construction equipment, tools, plants, machinery, temporary works, fabrication facilities, launching arrangements, testing facilities, and all resources required for successful execution of the Works.

The Works comprise construction of the Elevated Corridor with modern precast superstructure systems consisting of U-Girders, Strutted Box Girders, and Ultra High Fibre Reinforced Concrete (UHFRC) structural components, including UHFRC I-Girders for long-span portal frame arrangements, complete in all respects as indicated in the Concept Drawings and detailed designs approved by the Employer. The scope shall also include construction of elevated rotary structures at identified junctions using strutted box girder systems, integration with and connection to existing flyovers at first-level configurations, and provision of second-level flyover connectivity crossing above existing flyovers through portal frame arrangements supported on UHFRC I-Girders.

The Contract shall further include construction of all merging and diverging loops, ramps, slip roads, approaches, and connections to existing elevated corridors and road networks, together with associated civil, structural, electrical, mechanical, and traffic engineering works. The scope shall include construction and completion of drainage systems, medians, traffic islands, box culverts, retaining structures (temporary and permanent), compound walls for CPWD quarters wherever affected, road furniture, crash barriers, noise barriers, road markings, signage systems, painting and protective coatings, illumination and electrical installations for grade separators and elevated structures, landscaping works, utility shifting/protection works, safety measures, traffic diversion arrangements

during construction, and all other appurtenant works necessary for completion and operational functionality of the Project.

The Contractor shall coordinate with all concerned Government Departments, Utility Agencies and Statutory Authorities for identification, protection, diversion, relocation and shifting of existing utilities falling within the Project limits, including preparation and submission of drawings, estimates, proposals, demand applications and all necessary documents required for obtaining approvals and utility shifting permissions.

All statutory utility shifting charges, supervision charges, departmental deposits, restoration charges, demand note amounts and other payments payable to Government Departments, Utility Agencies or Statutory Authorities towards utility shifting/relocation shall be borne and remitted by the Employer/Client directly to the concerned authorities. However, the Contractor shall provide all necessary technical assistance, liaisoning support, documentation, survey details, traffic arrangements and coordination required for processing and execution of such utility shifting works.

In the event the Contractor, with prior approval of the Employer/Engineer-in-Charge, remits any utility shifting charges or deposits to the concerned authority for expeditious execution of the Project, the same shall be reimbursed to the Contractor upon submission of original demand notes, paid challans/receipts, supporting correspondence and proof of payment to the satisfaction of the Employer.

The Contractor shall be solely responsible for the adequacy, stability, safety, quality, durability, and performance of the design and construction, and shall execute the Works in compliance with applicable IRC, MORTH, BIS, and other relevant codes, standards, specifications, statutory requirements, and directions of the Employer/Engineer-in-Charge.

The quoted Contract Price shall be deemed to include all costs towards taxes, duties, levies, royalties, licence fees, patent rights, insurance, labour cess, ESI, PF contributions, municipal and local taxes, octroi, transportation, loading/unloading, incidental expenses, and all other statutory obligations applicable to the execution of the Works, excluding Goods and Services Tax (GST). GST at applicable rates prevailing at the time of payment shall be paid separately as admissible under the Contract. No additional claim or compensation on account of any such taxes, duties, levies, or incidental charges shall be entertained by the Employer.

1.2 Site

The proposed Project Road for "Construction of Elevated Corridor from Sirsi Circle to Nayandahalli on Mysuru Road (Length approximately 5.2 km) in Bengaluru City" is situated within Bengaluru Urban Area, Karnataka, and traverses along the major urban arterial corridor of Mysuru Road connecting Sirsi Circle, Vijayanagara, Gopalan Arcade Corridor, Gali Anjaneya Temple Junction and Nayandahalli Junction.

The Project Corridor commences from Sirsi Circle Junction and generally follows the existing Mysuru Road corridor towards Nayandahalli existing elevated flyover. The proposed alignment passes through major urban traffic influence zones including Sirsi Circle, Chamarajpet connectivity zone, Vijayanagara, Gopalan Mall Junction, Gali Anjaneya Temple Junction and Nayandahalli Junction, integrating with existing flyovers, grade separators, metro infrastructure and major arterial road networks within Bengaluru City.

The proposed elevated corridor consists of split elevated carriageway/loop flyover arrangements and bi-directional elevated viaduct systems planned to optimize traffic distribution, reduce congestion at major junctions and provide uninterrupted grade-separated traffic movement along the Mysuru Road corridor.

From Sirsi Circle to Gopalan Mall Junction, split/loop elevated flyover systems are proposed to facilitate directional traffic dispersal and integration with adjoining junction movements. From Gopalan Mall Junction up to Gali Anjaneya Temple Junction, a bi-directional elevated corridor configuration is proposed. Further, from Gali Anjaneya Temple Junction up to the existing Nayandahalli Flyover, split elevated carriageway systems are proposed for directional traffic segregation and smooth connectivity with the existing elevated road network.

Traffic movement from Vijayanagara side towards Sirsi Circle is proposed to be integrated through the existing flyover structure near Gali Anjaneya Temple Junction by means of suitably designed cantilever structural systems, portal frame arrangements and elevated connectivity structures to merge with the proposed bi-directional elevated corridor towards Sirsi Circle.

The proposed elevated corridor shall provide seamless traffic integration with the existing Nayandahalli Flyover system and other existing grade separators/flyovers along Mysuru Road, thereby enabling continuous and efficient vehicular movement between Central Bengaluru and the western corridor of Bengaluru City.

The corridor primarily follows the existing Mysuru Road right-of-way and includes elevated viaducts, split carriageways, loop ramps, portal frame structures, cantilever pier arrangements, entry/exit ramps, slip roads, junction improvement works, utility integration works, traffic management systems and associated civil, structural, drainage, illumination and road infrastructure works as indicated in the Concept Alignment Drawings.

The Location of the Project is shown below:

1.3 Works to be carried out

The Works to be carried out under this Turnkey Contract shall include

a. Preliminary works including setting out of the alignment, establishment and maintenance of permanent benchmarks and reference points, detailed engineering design, preparation and obtaining approval of the General Alignment Drawings (GAD) for the Elevated Corridor along with connected ramps on all sides of the junction roads including approach roads. The scope shall also include preparation and approval of the general alignment for the proposed elevated corridor extending from Sirsi Circle to Nayandahalli on Mysuru Road (Length 5.2kms) in Bengaluru city.

b. Clearing of Site before Commencement of Work and Site Clearance at Acquired Government and Private Property, if any.

c. Topographical Survey and Setting out of Works.

d. **Geotechnical Investigations and taking Trial Bores**: The Geotechnical Investigation Results given in this Document is only indicative and the same is shown in the Tender drawing. The Tenderer shall make his own Assessment and his Lump Sum Offer is for the whole Item of the Work, (All the Items described in this Tender Document and Drawings) and for any Variations observed at Site in respect of Levels and Soil Particulars, etc. The Tenderer's offer is deemed to have been made considering the Actual Ground Conditions at Site and he shall not be eligible for any claim whatsoever. During Execution of the Work, the Contractor shall carry out Geotechnical Investigation as per IRC: 78 at all Piers / Abutments of elevated corridor, at Selected Points of Retaining Wall, and at any other Locations required for the Design of the Works in conformity to the Prevailing Norms and Codal Provisions.

e. The Successful Tenderer, on Award of Work, shall map all the Existing Service Lines, above and below the ground level within the Battery Limit, such as Water Supply, Underground Drainage, Electrical, Telephone, Optical Fibre Cables, etc. Mapping of the Service Lines below the Ground Level shall be carried out using Ground Penetrating Radar (GPR) Equipment. Mapping shall be submitted to Authority (Client) for getting approval and estimation from all the respective Service Departments.

f. Relocation of Utility and Service Lines such as Water Supply, Underground Drainage, Electrical, Telephone, Optical Fibre Cables, etc. those are incidental and obstructing, are to be permanently diverted in an acceptable manner to the Concerned Service Departments so that not to hinder the Services of the Lines at the Cost of the Employer. The Shifting, Supervision Charges, Deposits, if any, to be payable to the Concerned Government Departments shall be borne by the Employer. The Employer will help in Liaising with the Concerned Authorities regarding the Need to shift the Service Lines in case of requirement. Based on his own Investigations as mentioned in the above Clause the Contractor shall make his own Plan for Provision / Diversion of the Service Lines and ascertain the entire Scope of Work and other Required Details by himself and the Employer shall not take any responsibility other than remitting the shifting charges /Liaisoning with the Concerned Departments as stated above. The Time Schedule of 18 (Eighteen Months) is inclusive of the Period of Utility Shifting also and no Extension of Time would be granted due to Delay in this Work without valid reason. No Monetary Claim in whatsoever manner shall be entertained separately.

g. Removal and Relocation of Existing Bus Shelters within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer. The employer will bear the costs of removal and relocation.

h. Shifting of Existing Kerb Stones within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer.

i. Removal of Existing Traffic Signages and Signals within the Battery Limit, if any, as approved by the Employer.

j. Removal of Existing Hoardings, Advertisement Boards and Appurtenant Structures within the Battery Limit, if any, as approved by the Employer.

k. Dismantling of existing road at median locations for piling works and Disposal of Earth / Debris of existing RCC and Masonry Structures, PCC, existing Road Pavements, RCC / SSM Drainage Structures, Tree Roots, Culverts, Medians, Kerbs, Traffic Islands, Earth Retaining Structures, Ducts, Hoarding and Advertisement Boards and Appurtenant Structures, etc. required for the Execution of the Work.

l. Salvage Value Adjustment and Ownership of Recovered Materials
The estimated project cost and tender value have been prepared after accounting for the salvage value of recoverable materials expected to be generated from dismantling, demolition, site clearance, and tree-cutting activities associated with the work. The scope includes dismantling of existing road pavements at median locations for piling works, demolition and disposal of earth/debris arising from existing RCC and masonry structures, PCC, road pavements, RCC/SSM drainage structures, culverts, medians, kerbs, traffic islands, earth-retaining structures, ducts, hoardings, advertisement boards, tree roots, and all other appurtenant structures required for execution of the project.

The salvage value of reusable materials has already been deducted from the estimated project cost based on the quantities assessed during project preparation, comprising approximately 370 Cum of reusable concrete aggregates recoverable from 3,705 Cum of dismantled concrete @ 100/cum, about 0.85MT of scrap HYSD reinforcement steel recoverable from dismantled RCC structures @ 39505/MT, and approximately 20 MT of timber/wood recoverable from tree-cutting operations @ 2500/mt. The total assessed salvage value considered for recovery in the estimated cost is Rs.1,19,977/-.

Accordingly, all salvage materials covered under the Schedule of Credit, including reusable concrete aggregates, scrap reinforcement steel, timber/wood from felled trees, and other listed recoverable materials, shall become the property of the Contractor, who shall be permitted to remove, reuse, recycle, auction, or otherwise dispose of such materials at his own discretion, without any additional payment from the Employer, since the corresponding salvage value has already been adjusted in the project cost. The rates adopted for salvage value assessment are fixed by the Department and no claim whatsoever shall be entertained on account of any variation between the assessed salvage value and the actual market value realized by the Contractor.
The quantities of salvage materials indicated are provisional estimates only, and the actual quantities shall be determined based on measurements recorded during execution. Any materials obtained from demolition or dismantling activities but not specifically included in the Schedule of Credit shall remain the property of the Employer/Government and shall be handed over to the Engineer-in-Charge/BSMILE without any extra payment or compensation to the Contractor.

m. Construction of Temporary and Permanent Earth Retaining Structures, Compound, Barrication, Fencing, Dewatering, Drainage Facilities and all Temporary Structures wherever required during Construction.

n. Regarding of existing Ground Levels to achieve the required Vertical Clearance for elevated flyover for first and second levels, Drainages, etc. including Disposal of Excavated Earth and Debris to the Location identified by the Contractor where the same shall not cause Nuisance and shall be acceptable to the Authorities concerned.

o. **Traffic Diversion**: Within project road scope area, the tenderer shall ensure that the Traffic Movement during the Construction of the Works is properly diverted, maintained and obstruction to the Traffic Movement is kept to the minimum. Traffic Movement in Construction area shall include but not be limited to the following.

- Preparation of the diversion plan in consultations with Client or his representative and shall be submitted to Client for further approval from Concern department /Police for their approval and public notification if any.
- All Necessary Arrangements required at various location as per approved plan i.e. Sign boards, Cautionary Boards and delineators to warn, inform, guide and control drivers/ riders etc. to be provided.
- Provide Skilled Flagmen for Traffic Diversion as per the Requirement of Concerned Department.

- Provide Traffic Barricades with Blinkers, Reflective Tapes, Road Delineators, Traffic Cones, Portable Signage's, Reflective Lights and other necessary Traffic Signage as required, as directed by the Concerned Authorities and as per the Specification. Construction zone area.

- Prior approval of Traffic Diversion plan from the employer is necessary. If any new diversion road work requires for smooth traffic flow Tenderer to execute work with prior approval of Authority under Additional / Variation work as per special condition clause no 67 i.e. variation.

- After Completion of the Work, if in opinion of Authority wearing course/40mm Bituminous Concrete/Micro surfacing on diverted road are requiring than Tenderer should execute the work at the cost of employer.

p. **Barrication around the Construction Area**

- The Contractor shall be required to keep the Site as Safe and Secure as possible at all times, including the Erection of Site Perimeter Hoarding, which shall also deter trespassers both adult and children alike, as per the Approval of the Employer.
- The Contractor shall provide a solid two meter high securely erected Barricade including Lights over Barricades at night around the perimeter of the Site as per the Approval of the Employer, with Agreed and Guarded Access and Egress Points for both personnel and vehicles.
- At each entrance to the Site, the Contractor shall erect a large Billboard warning all persons who enter the Site that they are required to wear the Appropriate Personal Protective Clothing and that no Unauthorized Access is allowable.
- Wherever the Barricade borders on Pedestrian Footpath, Lightings shall be provided to illuminate the Pedestrian Routes. The Positioning of the Barricade Line shall not reduce the Width of Pedestrian Footpath to less than 900mm.
- Site Perimeter Barricade shall be washed at least once a month and repainted at least annually.
- The Site Barricade shall need to be inspected on a regular basis in order to ensure that the Integrity of the Fencing is maintained at all times as far as practicable.

q. Providing and Erecting Project Information Display Board (minimum size 2.5m X 1.5m) at minimum ten (10) different locations in and around the Project Area as approved by the Employer.

r. The Successful Tenderer, on Award of Work, shall coordinate with KPWD, NHAI Traffic Police, BDA, BESCOM, BSNL, BWSSB, BMRCL, KPTCL, B-SMILE and other Agencies associated with the Construction of Works and comply with their Requirements. The Employer will provide assistance only.

s. The Successful Tenderer, upon award of the Work, shall prepare detailed General Alignment Drawings (GAD) for the proposed Elevated Corridor, including approaches, elevated rotary structures at junctions, second-level elevated structures, and portal frame locations, in consultation with the concerned BSMILE Engineers. The Contractor shall obtain in-principle approval of the detailed GAD from an approved Third-Party Proof Consultant such as Indian Institute of Technology / Indian Institute of Science by following applicable IRC guidelines and procedures prior to commencement of the Works.

The submission for Third-Party scrutiny and approval shall include, but not be limited to:

i. GAD Checklist and compliance statement as per applicable IRC provisions and standards;

ii. Detailed structural design calculations, drawings, analysis reports, and design basis reports for the proposed Elevated Corridor, elevated rotary structures, portal frames, ramps, and associated structures; and

iii. Detailed Geotechnical Investigation Reports for each pier/foundation location of the elevated corridor, duly signed and sealed by the investigating authority on each page, indicating existing ground levels, reduced levels at borehole locations, soil strata details, Safe Bearing Capacity (SBC), groundwater table, and all other relevant geotechnical parameters required for structural design.

The Employer shall extend necessary assistance for coordination and review; however, approval for implementation of the design and drawings shall be accorded only after recommendations and proof-check certification by the approved Third-Party Scrutiny Agency as per the direction of Engineer –in-charge.

t. Structural design and drawing work for Foundation, sub-structure, super structure, precast elements drawings as per relevant IRC, and other codes for the Elevated corridor and Rotary junction shall be prepared. However design and drawings along with launching schemes arrangements for long span to be proof checked by Indian Institute of Technology /Science/National Institute of Technology is mandatory for submission to BSMILE department at the risk and cost of the Successful tenderer for getting approval for execution.

u. After completion of proof checking and scrutiny by approved institutions such as Indian Institute of Technology / Indian Institute of Science / National Institutes of Technology, the Successful Tenderer shall obtain approval of the detailed structural designs and drawings for the Elevated Corridor, elevated rotary structures, second-level elevated structures, portal frames, ramps, approaches, and all associated components from the concerned Engineers of B-SMILE. Thereafter, the Contractor shall prepare and issue Good for Construction (GFC) Drawings, fabrication drawings, launching schemes, working drawings, and all other drawings/documents required for execution, construction, and completion of the Elevated Corridor Project and associated structures in accordance with approved designs and applicable standards.

v. Construction of Elevated corridor including Foundations, Sub Structure, Super Structure for Via Ducts and Intermediate and Obligatory Span, Construction of Reinforced Earth Retaining Walls, RCC Retaining Walls, Backfill between RE Walls / Retaining Walls, Soil Stabilization below RE Panels, Filter Media, Kerbs, Crash Barrier, Crash barrier , noice barrier for elevated corridor as per requirements of B SMILE, Complete Drainage System with Down Take Pipes, Wearing Coat, Water Proofing, Hand Rails to Crash Barriers, Expansion Joints, Bearings, Painting, Deck and Surface Road Illumination, etc. complete in all respects as per MoRT&H / IRC / BIS Specifications.

w. The Scope shall include all the above Works within the Battery Limit. The Battery Limits for the Junctions are indicated in Concept and Alignment plan drawing SSP/DWG/PRJ/2025-26/19-7 for Comprehensive plan of Mysore road and development of Road corridors works within the Battery Limit. The Tender Drawings furnished are only for guidance and understanding of the project concept and scope. The Contractor shall prepare, review, modify, revise, and generate all further detailed engineering drawings, working drawings, plan and profile ,construction drawings, shop drawings, and coordinated utility/drainage drawings as required for execution of the Works in conformity with the approved scope, site conditions, IRC/MoRT&H standards, and directions of the Employer. No additional drawings other than the Tender Drawings shall be provided by the Employer.

x. All such detailed drawings and designs shall be got approved by the Employer / Engineer-in-Charge before commencement of execution

y. The scope also includes construction of a compound wall of not less than 487 m in the project corridor including in Police Quarters.

z. The scope of the Contract shall also include restoration and reconstruction of existing roads damaged during execution of pile foundations, utility works, excavation, movement of construction equipment, or any other construction activities along the Elevated Corridor alignment. Reconstruction shall be carried out for the full extent of the affected and influence areas of such damages, as directed by the Engineer-in-Charge. The restored roadway shall conform to the same or higher specification, composition, pavement crust, and riding quality as the existing road condition prior to commencement of the Works.

aa. The scope of the Contract shall also include construction of slip roads at identified locations along the Project Corridor, as directed by the Engineer-in-Charge of B-SMILE, for an aggregate length of up to 1.2 km. The slip roads shall comprise carriageway of 5.5 m width with Thin White Topping pavement, including a 1.5 m wide buffer/service zone with 80 mm thick paver block finish accommodating Storm Water Drain (SWD) arrangements through NP3 pipes, footpaths of 2 m width with 60 mm thick paver blocks, utility chambers, street lighting, water supply lines, sewerage connections, drainage arrangements, and all associated civil and utility works. The works shall include complete surface finishing, road furniture, kerbs, ducting, utility integration, and all incidental works required for completion in all respects. The exact locations, chainages, and extent of such slip roads shall be decided and instructed by the Engineer-in-Charge during execution of the Project depending upon site requirements and traffic integration needs.

bb. Providing Gantry, Traffic Signals, Traffic Signages, Road Marking and Granite name plate engraver along with necessary Pedestals, Foundation Stone, Stone for Inauguration Ceremony as per Specifications and as per the Approval of the Employer.

cc. Necessary Drainage Arrangement as per Specification. The Levels and Dimension Details for Drainage Arrangement shown in the Tender Drawing are only indicative. The Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study and get the Drawing approved by the Employer before Execution.

dd. Set up of Field Laboratory.

ee. Adequate Street Lighting / Junction Lighting Arrangements as approved by the Employer during Construction.

ff. **Removal / Disposal**: Removal / Disposal of Excess / Disused Earth, Soils, Debris and Materials from the Construction Site. Further, it is the responsibility of the Contractor to identify the Dumping Yard Location and to dispose the Excess / Disused Earth, Soils, Debris and Materials to the same identified Dumping Yard where the same shall not cause Nuisance and shall be acceptable to the Authorities concerned.

gg. Dewatering in Foundation, Trenches, Drainages, wherever required, and pumping out to Locations as directed by the Employer.

hh. All Necessary Safety Measures / Precautions to be adopted at Site as per the Instructions of the Employer.

ii. Providing and maintaining Furnished Site Office for the Supervisory Staff of the Employer and his approved Representative.

jj. Making good the Road Surface as per IRC Standards, which are damaged / worn out during Construction of the Work and restoring the same to the Original Status.

kk. Any other Items of Works, which are not specifically enumerated in the Tender Document, but required for Functioning of all the Infrastructures Developed and as per the Directions of the Employer.

ll. Construction of Architectural Features required for Good Aesthetics of the Infrastructure developed.

mm. Painting with Approved Colour, Shade, Make and Type shall be provided for the various Elements as per the Specifications given in the Tender Document.

nn. The Contractor shall ensure Cleanliness of the Work Area and its surroundings by deploying Man Power for the same. The Contractor shall have to ensure proper Brooming, Cleaning and Washing of Work Area till the Currency of the Contract including Disposal of Sweepage. Nothing extra shall be payable on this account

oo. Cleaning of the Site after Execution and before handing over the Project to the Employer.

pp. The Defect Liability Period (DLP) for the Project shall be Ten (10) Years from the date of issue of Completion Certificate/Provisional Completion Certificate. During the Defect Liability Period, the Contractor shall be responsible for rectification of all defects, deficiencies, settlement, leakages, damages, structural distress, wearing surface failures, expansion joint failures, bearing failures, drainage deficiencies, and all other defects arising out of defective design, workmanship, materials, construction practices, or maintenance obligations at no additional cost to the Employer. For major structural components including portal frames, UHFRC girders, elevated rotary structures, foundations, piers, bearings, and expansion joints, the Contractor shall remain fully responsible for structural performance, safety, durability, and serviceability during the Defect Liability Period.

oo. The detailed scope of work shall be finalized at the time of award of work and the tender document also forms part of the contract document

2.0 Design Criteria

2.1 General and Approach to Work Site

The Site Particulars are shown in the Topographical Map. Refer Tender Drawings no. SSP / DWG / PRJ / 2025-26 / 19-6

2.2 Benchmarks and Setting out of Works

a. The Standard Benchmark and its Reduced Level with reference to which the Work shall be carried out is the GTS Benchmark available nearest to the Site. The Employer does not take the responsibility about the Correctness of the Levels indicated in the Drawings. The Contractor has to establish at least fifteen Benchmarks in the Site of Works with Reduced Levels clearly marked on them. The Contractor shall be solely responsible for the accuracy of the Benchmark Levels and for maintaining the same throughout the Contract Period.

a. The Works shall be set out in accordance with the Drawings approved by the Employer.

b. The Contractor shall be responsible for the True and Proper Setting out of the Works and for the Correctness of the Positions, Levels, Dimensions and Alignments of all Parts of the Works and for the Provision of all Necessary Instruments, Appliances and Labours in connection therewith. The Contractor shall give at least 48 hours' notice to the Employer of his intention to set out or give Levels.

c. If at any time during the Progress of the Work, any Error appears or arises in the Positions, Levels, Dimensions and Alignments of any part of the Work, the Contractor shall at his own expenses and risk, rectify such Errors to the satisfaction of the Employer.

d. The Checking of any setting out of any line or level by the Employer or his approved Representative shall not relieve in any way the Contractor of his responsibility for the Correctness thereof and he shall carefully protect and preserve all the Benchmarks, Site Rails, Pegs and other Things used in the setting out of Works.

f. All Duties concerning Establishment of a Set of Benchmarks, Permanent Stations, Centre Line Pillars, etc. for performing all the Functions necessary at the Commencement and during the Progress of Work till the Physical Completion of all the Items of the Work in question, shall be carried out by the Contractor at his own risk and cost.

e. The Centre Line of the Elevated Corridor and its approaches, Rotary, Piers of Flyovers, Abutments, RE Walls, Surface Level Roads / Slip Roads, Corridor, Electrical room for Railways, Drainage Facilities and the Foundations shall be established by Total Station Equipment and the Centre Line Marks shall be engraved on smoothly finished masonry or concrete pillars of such dimensions and constructed at such intervals and places as may be directed by the Employer or his approved Representative and shall be maintained in proper manner throughout the Period of Construction. The Contractor shall submit a Drawing showing the Alignment of Elevated Corridor, elevated Rotary, Diverging and merging loops, plan of corridor at second levels, connectivity details of corridor with metro double decker flyover, Surface Level Roads / Slip Roads, Corridor and Drainage Facilities within 15 (fifteen) days from the Date of Signing of Agreement.

f. He shall also keep proper Record of such Permanent Benchmarks established denoting therein their Correct Levels.

g. The Work of Establishment of all such Benchmarks shall be carried out by only experienced and skilled staff of the Contractor with the help of precise instruments suitable for this type of Work. The instruments used shall be checked for their accuracy and for permanent adjustments before the commencement of the Work and also at frequent intervals during the progress of the Work.

j. All such Benchmarks established by the Contractor shall be subject to check and approval of the Employer or his approved Representatives. If any Variations noticed in the Work as result of improper establishment or maintenance of such Benchmarks, it shall be rectified at the Contractor's own Risk and Expense.

2.3 General Requirements

In order that the Tenderer's Proposal qualifies as an Alternative Design, it shall generally fulfill the following Requirements.

a. It shall ensure Soundness of the Structure, its Durability and Aesthetics as a whole in harmony with the surroundings. A Report on the Aesthetic Aspect shall be compulsorily in the Technical Bid.

b. It shall ensure Speedy and Practicable Construction.

c. It shall lead to Appreciable Economy in the Design.

d. It shall be accompanied by Detailed Drawings and Detailed Description of Work and Specification of Materials and Items. If called upon, the Tenderer shall explain his Proposal through Power Point Presentation during Tender Evaluation Stage before Opening of Financial Bid.

e. At the time of Detailed Design, the Contractor shall not deviate from the Basic Scheme proposed by him for the purpose of Tender. At the same time, it is mandatory on the part of the Contractor to strictly adhere to all the Geometric Details indicated in the Tender Drawing. The Length of the Ramp could marginally change based on Structural Scheme and Designs after Approval by the Employer.

f. The Alignment of the Elevated corridor, Rotary, Surface Level Road and Drainage Facilities, Electrical, compound wall shown in the Drawings appended with the Tender Document shall be followed by all the Tenderers, and if Any alteration / modifications in alignment plan is proposed by the bidder in the better way resulting with further reduction of the cost of land acquisition and project cost will be subjected to employer approval,

g. The Superstructure shall be designed with minimum feasible expansion joints to ensure smooth, safe, low-noise, and uninterrupted riding quality for vehicular traffic. Expansion joints shall be provided only at structurally essential locations based on design requirements, temperature effects, creep, shrinkage, seismic considerations, and overall structural behaviour.

The Contractor shall adopt modern joint systems such as Modular Strip Seal Expansion Joints, Strip Seal Joints, Link Slab arrangements, Integral/Semi-Integral Deck Systems, or equivalent approved technology conforming to relevant IRC/MORTH specifications to achieve enhanced riding comfort, watertightness, durability, reduced maintenance, and long service life.

Conventional joints causing excessive noise, leakage, vibration, riding discomfort, or high maintenance requirements shall not be permitted unless specifically approved by the Engineer-in-Charge."

h. Only single-pier type structural arrangements shall be adopted for Elevated Rotary Flyovers, unless otherwise approved by the Employer. The pier configuration and geometry shall be architecturally and aesthetically designed to suit the urban environment, with preference given to elliptical, circular, streamlined, or architecturally treated ornamental pier shapes of modern/classical appearance. The design shall ensure structural stability, durability, minimum obstruction to traffic movement below, and visual harmony with surrounding infrastructure. The final selection and approval of pier shape, architectural treatment, and aesthetic

appearance shall rest solely with the Employer, and the decision of the Employer in this regard shall be final and binding on the Contractor.

i. The Tenderer shall note that it is a Requirement for Qualification that the Works warrant that the Structure proposed shall be aesthetically pleasing and easy to maintain considering the Importance of the Work Location.

2.4 Specifications for Design and Codes to be followed

a. The Design, Analysis, Detailing, Proof Checking, Fabrication, Construction, Testing, and Performance Requirements of all Structural and Non-Structural Components of the Works shall conform to the latest applicable editions, amendments, corrections, and revisions of relevant Indian Roads Congress (IRC), Ministry of Road Transport & Highways (MoRTH), Bureau of Indian Standards (BIS/IS Codes), and other applicable national/international standards prevailing as on the date of issue of the Notice Inviting Tender (NIT).

b. The design of the Elevated Corridor, Elevated Loop Structures, Portal Frames, UHFRC / UHPC Structural Components, Precast Segmental Structures, U-Girders, Strutted Box Girders, Foundations, Bearings, Expansion Joints, Pavements, Drainage, and associated works shall generally comply with, but not be limited to, the following Codes, Manuals, Specifications, and Guidelines:

c. Applicable IRC / IS / MoRTH Codes and Standards

- IRC:5 – Standard Specifications and Code of Practice for Road Bridges – Section I: General Features of Design
- IRC:6 – Standard Specifications and Code of Practice for Road Bridges – Section II: Loads and Stresses
- IRC:15 – Standard Specifications and Code of Practice for Construction of Concrete Roads
- IRC:18 – Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete)
- IRC:21 – Standard Specifications and Code of Practice for Road Bridges
- IRC:22 – Composite Construction (Limit State Design)
- IRC:24 – Standard Specifications and Code of Practice for Steel Road Bridges
- IRC:35 – Code of Practice for Road Markings
- IRC:37 – Guidelines for the Design of Flexible Pavements
- IRC:38 – Guidelines for Design of Horizontal Curves for Highways and Design Tables
- IRC:39 – Standards for Road-Rail Level Crossings
- IRC:44 – Guidelines for Cement Concrete Mix Design for Pavements
- IRC:54 – Recommendations for Lateral and Vertical Clearances at Underpasses for Vehicular Traffic
- IRC:58 – Guidelines for the Design of Plain Jointed Rigid Pavements for Highways
- IRC:65 – Recommended Practice for Traffic Rotaries
- IRC:67 – Code of Practice for Road Signs
- IRC:71 – Guidelines for Design of Road Intersections in Rural Areas
- IRC:78 – Standard Specifications and Code of Practice for Road Bridges – Foundations and Substructure
- IRC:79 – Recommended Practice for Road Delineators
- IRC:83 (Part I, II & III) – Bearings for Road Bridges
- IRC:86 – Geometric Design Standards for Urban Roads in Plains
- IRC:92 – Guidelines for Design of Interchanges in Urban Areas
- IRC:103 – Guidelines for Pedestrian Facilities
- IRC:112 – Code of Practice for Concrete Road Bridges (Limit State Design)
- IRC:SP:19 – Manual for Survey, Investigation and Preparation of Road Projects
- IRC:SP:23 – Vertical Curves for Highways
- IRC:SP:37 – Guidelines for Evaluation of Load Carrying Capacity of Bridges
- IRC:SP:42 – Guidelines on Road Drainage
- IRC:SP:50 – Guidelines on Urban Drainage
- IRC:SP:56 – Guidelines for Steel Pedestrian Bridges
- IRC:SP:57 – Guidelines for Quality Systems for Road Construction
- IRC:SP:84 – Manual of Specifications and Standards for Four Laning of Highways through PPP
- IRC:SP:87 – Manual of Specifications and Standards for Six Laning of Highways through PPP

- IRC:SP:90 – Manual for Grade Separators and Elevated Structures
- IRC:SP:114 – Guidelines for Seismic Design of Road Bridges
- IRC:SP:117 – Specifications for Structural Bearings
- IRC:SP:124 – Guidelines for Use of High Performance Concrete
- MoRTH Specifications for Road and Bridge Works (Latest Edition)
- Indian Railways Bridge Manual, wherever applicable
- IS:456 – Plain and Reinforced Concrete – Code of Practice
- IS:800 – General Construction in Steel – Code of Practice
- IS:1343 – Code of Practice for Prestressed Concrete
- IS:1786 – High Strength Deformed Steel Bars and Wires
- IS:1893 – Criteria for Earthquake Resistant Design of Structures
- IS:2911 (All Parts) – Design and Construction of Pile Foundations
- IS:3370 – Code of Practice for Concrete Structures for Storage of Liquids, wherever applicable
- IS:383 – Specification for Coarse and Fine Aggregates
- IS:10262 – Concrete Mix Proportioning Guidelines
- IS:4926 – Ready Mixed Concrete
- IS:875 – Design Loads (Other than Earthquake)
- IS:16700 – Tall Concrete Structures, wherever applicable
- Relevant ASTM, AASHTO, fib Model Code, PCI, Eurocodes, and international recommendations for UHFRC/UHPC technology wherever Indian standards are not available.

d. Special Provision for UHFRC / UHPC Technology

The design, material specifications, durability requirements, testing procedures, structural behaviour, connection systems, fatigue performance, ductility, serviceability, casting methodology, curing requirements, and quality assurance procedures for Ultra High Fibre Reinforced Concrete (UHFRC/UHPC) components shall conform to internationally accepted practices and guidelines such as fib Model Code, AFGC Recommendations, FHWA Guidelines, PCI Recommendations, or equivalent approved international standards in addition to applicable IRC and IS provisions.

The Contractor shall submit complete design basis reports, material characterization reports, trial mix reports, durability studies, fatigue performance studies, prototype testing results, and proof-check documents for approval by the Employer and Third-Party Proof Consultant prior to commencement of fabrication or construction works involving UHFRC/UHPC technology.

e. In case of conflict between various standards, the order of precedence shall generally be:

1. Specific provisions of the Contract;
2. MoRTH Specifications;
3. IRC Codes and Special Publications;
4. BIS / IS Codes;
5. International Codes/Standards approved by the Employer;
6. Sound Engineering Practice.

The latest revisions/amendments of all applicable codes and standards issued up to the date of submission of bids shall be applicable.

f. For Items not covered by any of the above Standards and Specifications, Sound Engineering Practice and Provisions of Relevant Codes of other Nations shall be referred. In this regard, Decision of the Employer shall be final and binding on the Contractor.

2.5 Order of Precedence in case of Conflict

In Case of Conflict between difference parts of Tender Document, the following Order of Precedence shall prevail.

1. Design Criteria as specified in Tender Document.
2. Instructions to Tenderers.
3. Special Conditions of Contract.
4. General Conditions of Contract.
5. MoRT& H / IRC Specifications.
6. Codes of Practice.

2.6 Soil Investigation to be carried out by the Contractor

The Contractor shall carryout complete Soil Investigation at his own risk and cost. The Boreholes shall be taken at the Final Locations of each Pier of elevated corridor / Abutment, at Selected Points of Retaining Wall, at elevated Portion of Rotary, loop portion and at any other Locations required for the Design of the Works prior to the Commencement of the Work to ascertain the Levels of Rock and its Quality, to obtain SBC at different Depths, Soil Stratification, Ground Water Table, etc. The Termination Level of the Borehole shall be determined by conducting SPT Tests. Three consecutive SPT Tests at an interval of 1.5m each with 'N' values greater than 100 shall be carried out before termination. If rock is encountered, Drilling shall continue upto 3m in rock with Rock Samples taken for Testing. All the Soil / Sub Soil Investigations and its Frequency shall be strictly in accordance with the Relevant Codal Provisions.

a. During Execution of the Work, the Samples from the Bore taken at each Foundation shall be tested and analyzed in the Laboratory approved by the Employer for establishing Design Parameters. Tests such as Standard Penetration Test, Compression and Shear Test on Undisturbed Soil Samples, Pressure Meter Test, Crushing Strength of Rock, California Bearing Ratio (CBR) Test, Plate Load Test, etc. shall be carried out in conformity with the MoRT&H Specifications. The Contractor shall submit the entire Data to the Employer along with his own / Laboratory Recommendations and obtain approval for the Design Parameters. Necessary Interpretation of the Result of Tests shall be furnished to the Employer for scrutiny of Design of Foundations.

b. The Cost of these Tests and Interpretation of the Test Results shall be considered, as incidental to the Main Work and the same shall be included in the Tendered Amount.

c. While checking the Stresses at the Base of Foundations, it shall be ensured that under the Worst Combination of Forces no Tension is permitted. The Safe Bearing Capacity at the Foundation Level shall be verified during Construction so that to ensure that the Stresses imposed on the Foundation Strata are within Permissible Limits.

2.7 Restrictions on Type of Structures

The following Types of Structural Arrangements / Systems shall not be permitted:

a. Structural systems requiring substantial quantities of imported proprietary materials, components, equipment, bearings, cables, fibers, admixtures, or technologies for which continuous foreign supply dependency and foreign exchange arrangements by the Employer would become necessary, unless specifically approved by the Employer.

b. Structural arrangements in which the stability, integrity, redundancy, or serviceability of one or more spans is critically dependent upon the performance or survival of adjacent spans, such that localized failure may result in progressive collapse or disproportionate structural distress.

c. Concrete structural systems incorporating hinges, half-joints, articulations, suspended spans, Gerber systems, or other discontinuity arrangements susceptible to leakage, durability deterioration, fatigue distress, impact loading, excessive maintenance, or riding discomfort.

d. Superstructure arrangements having joints at the tips of long cantilevers, hinge-supported suspended spans, pendulum-type bearings, gap slabs, or similar systems causing vibration, differential deflection, water leakage, riding discomfort, or high maintenance requirements.

e. Transversely continuous wide deck systems supported on structurally independent foundations or support systems without adequate provisions for differential settlement, seismic compatibility, torsional stability, creep, shrinkage, and long-term deformation effects.

f. Pier systems consisting of multiple columns, "Y"-shaped columns, split-column arrangements, hammer-head pier systems with excessive visual bulk, or any configuration causing obstruction to traffic movement, utility corridors, pedestrian movement, or future corridor integration, unless specifically approved by the Employer.

g. Structural systems involving excessive numbers of expansion joints, bearings, or deck discontinuities adversely affecting riding quality, watertightness, durability, noise performance, or long-term maintenance of the Elevated Corridor.

h. Any UHPFRC/UHPC structural system, connection detail, precast jointing arrangement, or construction methodology not supported by adequate analytical studies, prototype testing, fatigue verification, durability assessment, proof checking, and internationally accepted engineering practice.

i. Any structural arrangement resulting in difficult inspection access, complex replacement procedures, excessive lifecycle maintenance requirements, or long-term operational constraints for urban elevated corridor applications.

j. Preference shall be given to continuous, durable, low-maintenance, aesthetically pleasing, and near-jointless structural systems utilizing UHPFRC/UHPC technology with enhanced durability, riding comfort, structural redundancy, and lifecycle performance suitable for dense urban environments.

2.8 Concept and Alignment plan of Elevated Corridor

The concept and alignment plan of elevated corridor with diverging and merging with loop arrangements and approaches connecting to elevated rotary at sirsi circle junction, and extension of proposed flyover up to Nayandahalli Junction elevated corridor with bidirectional and split section, and connecting arrangements of corridor with NICE Junction and with all its approaches integrating with at grade road has been prepared and enclosed as part of tender document. Concept plan with alignment is prepared keeping in view of minimum land acquisition both in private and government properties. The land acquisition plan no SSP/DWG/PRJ/2025-26/19-8 also enclosed to understand the proposed right of way. The successful tenderer shall follow the concept plan for profile design within the proposed right way shown in LA plan without changing the concept. If there is any deviation in concept plan by minimizing the structural length as per the site condition up to the limit of 500m as decided by employer, contractor shall obtain prior approval from B-SMILE before commencement of design under this contract.

The Concept Plan and Alignment Plan for the proposed Elevated Corridor, including diverging and merging arrangements, loop ramps, approach structures, locations of proposed loop elevated structures, integration with the proposed Elevated structure at NICE Junction, and connectivity up to the existing Nayandahalli Elevated Corridor through split carriageway arrangements, and parallel running with Metro/Double-Decker corridor infrastructure along with associated approaches and at-grade road connectivity, have been prepared by the Employer and enclosed as part of the Tender Documents for guidance of the Tenderers.

The Concept Alignment has been developed considering minimum possible land acquisition affecting both private and Government properties while ensuring functional traffic integration, geometric standards, structural feasibility, and future corridor connectivity requirements. The proposed Right of Way (ROW) and land acquisition limits are indicated in the Land Acquisition Plan Drawing No. SSP/DWG/PRJ/2025-26/19-8 enclosed with the Tender Documents.

The Successful Tenderer shall generally adhere to the approved Concept Plan, proposed alignment, profile, second-level connectivity locations, traffic integration arrangements, and Right of Way indicated in the Tender Drawings while carrying out detailed design and preparation of General Arrangement Drawings (GAD). The Contractor shall ensure that the detailed design is developed substantially within the proposed ROW and without altering the basic approved concept, traffic circulation pattern, junction integration philosophy, second-level connectivity arrangements, or corridor integration provisions envisaged in the Concept Plan.

However, based on detailed site investigations, utility constraints, traffic engineering requirements, structural optimization, geometric improvements, construction feasibility, or field conditions encountered during detailed design, minor modifications/deviations in alignment or reduction in structural length up to a maximum cumulative limit of 500 m may be considered, subject to detailed techno-economic evaluation and prior written approval of B-SMILE before commencement of detailed design and execution under this Contract.

2.8.1 Structural Construction Scope for Proposed Elevated Corridor

The scope of this EPC Contract shall include detailed engineering, proof checking, design, procurement, construction, testing, commissioning, and completion of the Proposed Elevated from Sirsi Circle to Nayandahalli on Mysuru Road (Length 5.2kms) in Bengaluru city, including elevated viaducts, loops, ramps, second-level elevated structures, portal frame structures, approaches, utility integration works, drainage arrangements, road restoration works, electrical and illumination works, traffic management systems, and all associated civil, structural, architectural, and urban infrastructure works complete in all respects in accordance with the Conceptual Drawings, Scope of Work, Technical Specifications, applicable IRC/MoRT&H/BIS Standards, and directions of the Engineer-in-Charge.

The proposed elevated corridor system generally comprises UHPFRC based superstructure systems including UHPFRC U-Girders, UHPFRC Strutted Box Girders, and UHPFRC I-Girders of varying carriageway widths including 5.5m, 7.0m, 8.5m, and 20.2m wide elevated carriageways together with associated PSC pier caps, portal frame structures, rotaries, loops, double-level elevated structures, ramps, diaphragms, deck slabs, bearings, crash barriers, wearing course, utility integration systems, and associated substructure/superstructure components along the project corridor.

The chainages, carriageway widths, lengths, span arrangements, structural layouts, and configuration details indicated in the Conceptual Drawings and Abstract Tables are indicative in nature and intended primarily for conceptual planning, tendering, and estimation purposes. The successful EPC Contractor shall carry out detailed surveys, traffic studies, utility mapping, geotechnical investigations, structural analysis, proof checking, and detailed engineering and may suitably optimize the structural arrangement, span configuration, pier positioning, girder configuration, geometry, construction methodology, staging arrangement, and structural systems based on site conditions, traffic requirements, utility constraints, construction feasibility, safety requirements, durability considerations, and approvals from concerned authorities, subject to approval of the Engineer-in-Charge.

The Contractor shall generally adopt structurally efficient and aesthetically slender pier systems suitable for UHPFRC superstructure configurations with minimum obstruction to existing traffic movement, pedestrian circulation, drainage corridors, utilities, and future corridor integration. Pier systems consisting of multiple columns, "Y"-shaped columns, split-column arrangements, hammer-head pier systems with excessive visual bulk, or any configuration causing undue obstruction to traffic movement, utility corridors, pedestrian facilities, drainage arrangements, or future widening requirements shall generally be avoided unless specifically approved by the Engineer-in-Charge due to unavoidable site constraints or structural requirements.

However, notwithstanding the conceptual arrangements shown in the tender drawings, the Contractor shall be permitted to adopt technically suitable alternative structural configurations including cantilever pier systems, portal frame arrangements, single-column piers, balanced structural systems, split carriageway configurations, modified span arrangements, and optimized girder layouts wherever found feasible and advantageous during detailed design, particularly at locations involving split elevated carriageways, loops, rotaries, second-level structures, constrained right of way, utility conflicts, traffic integration zones, or multilevel interchanges, subject to compliance with applicable IRC/MoRT&H standards and approval of the Engineer-in-Charge.

The conceptual structural layouts shown in the Tender Drawings shall therefore be treated as minimum indicative conceptual requirements and shall not restrict the Contractor from proposing technically superior, economical, safer, aesthetically improved, or construction-friendly alternatives during detailed engineering, provided the overall functional requirements, corridor geometry, traffic integration, structural safety, durability, riding quality, maintainability, and project objectives are fully achieved to the satisfaction of the Engineer-in-Charge.

The detailed abstract of proposed elevated structural components, chainages, carriageway widths, lengths, and indicative structural arrangements is provided in the following Schedule/Table forming part of the Tender Document.

Sl. No.	Description	Chainage		Length in Km	Width in m
		From	To		
1	Proposed loop of Single Lane Flyover from existing Balagangadharanatha Swamy Flyover to Kudhure Park (LHS) including merging Tapering length.	0+000	0+968	0.968	8.50
2	Proposed loop of Intermediate Lane from existing Balagangadharanatha Swamy Flyover to Kudhure Park (RHS) including Tapering length of diverging / Merging.	0+000	0+968	0.968	8.50
3	Proposed intermediate Lane from Gopalan Mall to Sirsi Circle (RHS)	0+430	1+968	0.538	7.00
4	Proposed 2 Lane Flyover approach from Kudhure Park to Gopalan Mall (LHS)	0+695	0+895	0.200	8.50
5	Proposed 4 Lane Flyover from Gopalan Mall to Gali Anjaneya Temple to BHEL Junction near Vrishabhavati River Bridge	0+968	2+790	1.822	20.20
6	Proposed tapering intermediate Down Ramp near Bytarayanapura Police Station to BHEL Junction near Vrishabhavati River Bridge	2+405	2+755	0.350	7.00
7	Proposed 2 Lane Flyover from BHEL Junction near Vrishabhavati River Bridge to Existing Nayandahalli Flyover (Indian Oil Petrol Bunk)	2+790	3+450	0.660	8.50
8	Proposed 2 Lane Up Ramp from K.S.R.T.C Bus Depot No. 5 to BHEL Junction near Vrishabhavati River Bridge	0+000	0+270	0.270	8.50
9	Proposed 2 Lane Up ramp Loop from Vijayanagara to Proposed Flyover near Sri Gali Anjaneya Swami Temple Junction	0+000	0+460	0.460	8.50
10	Proposed intermediate loop lane Flyover from BHEL Junction to NICE Road	0+00	0+510	0.510	7.00
			Total length of Elevated Corridor	**6.746**	

2.8.2 At Grade Road Maintenance / Reconstruction & Utility Corridor Works

The scope of this Contract shall also include construction, reconstruction, maintenance, utility integration, drainage improvement, and restoration works for at-grade roads along the Project Corridor affected due to construction of the Elevated Corridor, pile foundations, pile caps, retaining structures, utility shifting, traffic diversion arrangements, movement of construction equipment, and other associated construction activities, as directed by the Engineer-in-Charge.

The works shall include construction of new at-grade/service/slip roads for an approximate cumulative length of 1200m with a typical overall cross-sectional width of 10.5m. The proposed cross section shall generally comprise:

i. 3.5m wide Thin White Topping carriageway with minimum 160mm thick concrete pavement,
ii. 1.5m wide hard shoulder/buffer/utility service zone on either side,
iii. 2.0m wide footpath cum utility corridor on either side,
iv. suitable drainage, utility chambers, utility ducts, landscaping and associated urban infrastructure works.

The carriageway shall be constructed using Thin White Topping pavement over approved base layers conforming to relevant IRC/MoRT&H Specifications. The footpath portions shall be provided with 60mm thick interlocking concrete paver blocks over PCC base/sub-base, while the hard shoulder/buffer utility zones shall be finished with 100mm thick heavy duty interlocking paver blocks over PCC base to facilitate utility maintenance access and service operations.

Water supply pipelines and sewer pipelines shall be provided continuously on both sides of the road corridor to eliminate future cross cutting of carriageways. The typical depth of water supply pipeline shall be about 1.0m below finished ground level and sewer pipeline depth shall generally be about 2.0m below finished level or as approved

by the Engineer-in-Charge based on site conditions and utility requirements.

Storm Water Drainage arrangements shall include NP3 pipes, catch pits, chambers, utility crossings, and associated drainage structures with SWD chambers proposed at intervals of about 20m c/c or as required based on hydraulic design. Utility ducts crossing the roadway shall generally be provided at intervals of about 250m or at locations required for utility integration and service connectivity.

Utility chambers/inspection chambers shall generally be provided at intervals of about 100m or as directed by the Engineer-in-Charge. Provision shall also be made for laying HDPE utility conduits/duct pipes within the utility corridor for future OFC cables, electrical cables, communication lines, smart city infrastructure, and other utility services without disturbing the finished pavement.

The scope shall further include construction of utility corridors, greenery/landscaping provisions, rainwater harvesting arrangements, drainage integration, utility crossings, service connections, and all associated civil and utility infrastructure required for complete functionality of the corridor.

Wherever pile foundations and pile caps are constructed along the median or carriageway portions of the existing corridor, reconstruction/restoration of affected roadway portions adjacent to RE walls, retaining structures, and construction zones shall be carried out for maintaining uninterrupted traffic movement and restoring the original roadway geometry and riding quality.

The scope shall also include restoration of all damaged existing roads along the Project Corridor irrespective of pavement type including:

i. Thin White Topping roads,
ii. Bituminous roads,
iii. footpaths,
iv. medians,
v. kerbs,
vi. utility corridors,
vii. drainage systems,
viii. road markings,
ix. and associated urban infrastructure.

The restoration shall match or improve upon the original pavement composition, crust thickness, riding quality, drainage characteristics, and serviceability of the pre-existing road condition.

The Contractor shall also carry out:

a. desilting and cleaning of existing roadside drains,
b. resetting/reconstruction of drain slabs,
c. repair of damaged drainage structures,
d. reconstruction of damaged kerbs and footpaths,
e. utility reinstatement works,
f. surface restoration works,
g. and all incidental works required for completion of the Project Corridor in all respects.

All at-grade road works, utility integration works, drainage arrangements, chambers, ducts, pavements, and restoration works shall conform to relevant IRC, MoRT&H, BIS, BBMP/B-SMILE Specifications and approved drawings.

2.8.3 Design Data

The design of the Elevated Corridor, approaches, elevated rotary structures, portal frames, and associated works utilizing UHPFRC/UHPC technology shall be based on the latest applicable IRC Codes, BIS/IS Codes, IRC Special Publications, MoRTH Specifications, relevant Ministry Circulars, and approved international standards/guidelines for UHPFRC/UHPC technology wherever corresponding Indian standards are not available.

a. **Location**

The locations of the proposed Elevated Corridor, elevated rotary/interchange structures, second-level elevated structures, ramps, loops, and associated approach arrangements are indicated in the Concept Drawings and Alignment Plans referred to in Clause No. 1.2 of this Section.

b. Type of Bridge

The Elevated Corridor shall generally follow the existing road alignment and shall comprise precast UHPFRC/UHPC superstructure systems with longer spans, generally of 45 m or above wherever feasible. The typical structural arrangement shall consist of PSC pier caps supporting precast UHPFRC U-Girders/Strutted Box Girders, while portal frame locations and second-level structures shall be supported on UHPFRC I-Girders or other approved structural systems suitable for the project requirements.

b. **Road Geometrics**

The geometric design of the Elevated Corridor, Elevated Rotary/Interchange structures, ramps, loops, and approach roads shall conform to the latest applicable provisions of IRC:65 "Recommended Practice for Traffic Rotaries", IRC:92 "Guidelines for the Design of Interchanges in Urban Areas", IRC:86, and other relevant IRC standards. The salient geometric requirements shall generally be as follows:

i. **Vertical Gradient**
The maximum longitudinal gradient for entry ramps, exit ramps, loops, and elevated approach structures shall generally be limited to 5% (1 in 20) or as permitted under relevant IRC provisions considering urban traffic conditions and design requirements.

ii. **Clearances**
The minimum vertical clearance between the finished road level and the soffit level of elevated structures, rotary flyovers, ramps, and associated superstructure components shall be 5.5 m or as specified in the latest applicable IRC/MoRTH standards.

d. **Minimum Viaduct Span**

The minimum span arrangement for the Elevated Corridor, Elevated Rotary structures, and portal frame portions, second-level elevated structures, and associated approaches shall generally not be less than 45m those indicated in Drawing No. SSP/DWG/PRJ/2025-26/19-7 enclosed with the Tender Documents. Any modification to the proposed span configuration shall be subject to detailed structural and geometric justification and prior approval of the Employer.

e. **Obligatory Span**

However, wherever longer or special span arrangements are required beyond the general span configuration along the Elevated Corridor due to site conditions, traffic requirements, road geometry, junction configuration, utility constraints, railway/metro crossing requirements, future integration provisions, navigational clearance, construction feasibility, or any other technical/functional requirements, such spans shall be treated as Obligatory Spans and shall be suitably designed by the Contractor in accordance with applicable standards and project requirements.

The detailed design and span arrangement for such Obligatory Spans shall be subject to review and prior approval of the Employer/Authority before commencement of execution.

f. **Requirement of UHPFRC Strutted Box Girder and UHPFRC I-Girder System**

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The Elevated Corridor and Elevated Rotary structures are proposed with modern precast Ultra High Performance Fibre Reinforced Concrete (UHPFRC/UHPC) Strutted Box Girder and slim-profile UHPFRC I-Girder systems to achieve reduced structural dead load, enhanced durability, longer spans, improved riding quality, minimum maintenance, faster construction, and improved aesthetics suitable for dense urban conditions.

The UHPFRC Strutted Box Girder system proposed for rotary/interchange portions shall be designed considering torsional behaviour, curved geometry effects, seismic forces, fatigue resistance, differential loading, and serviceability requirements. The closed box configuration and strutted arrangement shall provide enhanced torsional stiffness and structural efficiency for curved elevated corridor applications.

In addition, for short straight reaches having wider deck configuration of approximately 20.2 m roadway width, UHPFRC strutted box girder arrangements are also proposed considering structural efficiency, reduced number of supports, improved stability, and enhanced aesthetic appearance.

To facilitate rapid construction and minimize traffic disruption at critical junction locations such as Silk Board Junction and second-level elevated connectivity portions, portal frame arrangements supported on precast slim-profile UHPFRC I-Girders with longer spans generally in the range of 30 m to 40 m are proposed for Portal frame structures. The lightweight characteristics of UHPFRC girders shall enable faster launching, reduced erection time, reduced foundation loads, and improved construction efficiency in congested urban traffic conditions.

The Contractor shall finalize the detailed structural configuration, girder dimensions, prestressing arrangement, diaphragm configuration, bearings, connections, and erection methodology through advanced structural analysis and proof-checked design in accordance with applicable IRC, IS, MoRTH, and approved international standards for UHPFRC/UHPC technology.

For elevated rotary portions having significant curvature, suitable bearing systems such as POT-PTFE, spherical bearings, or equivalent approved systems shall be adopted considering torsional restraint, rotational requirements, seismic behaviour, durability, and long-term maintenance performance.

The preliminary conceptual arrangement of the UHPFRC Strutted Box Girder and UHPFRC I-Girder system is indicated in Drawing Nos. SSP/DWG/PRJ/2025-26/18-10-1, SSP/DWG/PRJ/2025-26/19-10-2 enclosed.

2.8.4 Description of Work and Elevated Corridor Provisions for Alternative Proposals

a. Alignment and Location

The Alignment, Longitudinal Profile, obligatory spans, second-level connectivity locations, elevated rotary arrangements, portal frame portions, ramp connections, loop arrangements, and other mandatory structural provisions for the proposed Elevated Corridor shall generally conform to the Concept Drawings and Alignment Plans indicated in Drawing Nos SSP/DWG/PRJ/2025-26/19-7 enclosed. Any modification/deviation proposed by the Contractor shall require prior review and approval of the Employer.

b. Layout of Elevated Corridor

The layout and geometric configuration of the Elevated Corridor, elevated rotary/interchange structures, ramps, approaches, loops, second-level structures, and associated elevated arrangements shall satisfy the following criteria in addition to requirements indicated in the Drawings and Supplementary Data:

i. Minimum vertical and horizontal clearances as per applicable IRC/MoRTH standards.

ii. Adequate open span lengths considering traffic movement below, junction clearances, utility corridors, aesthetics, visibility, and future integration requirements.

iii. Compliance with permissible ruling gradients and geometric standards for urban elevated corridors.

iv. Minimum lengths of summit and valley curves shall conform to IRC requirements for riding comfort, visibility, drainage, and operational safety.

v. Provision for integration with existing flyovers, metro/double-decker corridors, at-grade roads, slip roads, and future corridor connectivity.

vi. Any other criteria, mandatory provisions, or structural requirements indicated in the Concept Drawings and Tender Documents.

c. **Road Level and Roadway Particulars**

i. The proposed roadway configuration, carriageway widths, lane arrangements, rotary geometry, split carriageway sections, ramps, loops, utility corridors, and structural widths shall generally conform to Concept plan and cross sectional drawings enclosed with the Tender Documents. The Tender Drawings are only conceptual and indicative in nature, intended solely to represent the overall scope of work, typical sections, structural configuration, and project requirements.
Any additional engineering drawings, detailed site investigations, utility mapping, existing road geometry details with plan and profile, traffic management drawings, construction staging drawings, temporary works drawings, and other design details required for execution of the Project shall be generated by the Tenderer at his own cost based on actual site conditions and scope requirements, and wherever required, the same shall be submitted to the Employer for review/approval. No drawings other than those included in the Tender Documents shall be made available by the Employer.

ii. The vertical profile of the finished riding surface including deck slab, wearing course, ramps, and transition portions shall be designed as smooth continuous curves ensuring riding comfort, drainage, safety, and operational efficiency. Vertical and horizontal curves shall be designed in accordance with applicable IRC standards and shall be subject to approval of the Employer. The design speed for the Elevated Corridor and associated structures shall generally be 40 km/hr unless otherwise specified. Suitable camber, widening at curves, transitions, and super elevation shall be provided wherever required as per IRC provisions. Super elevation requirements for elevated rotary portions shall be designed considering traffic speed, operational safety, and geometric constraints.

2.8.5 Design Loads

a. Live Load

The Elevated Corridor, Elevated Rotary structures, ramps, portal frames, second-level elevated structures, PSC Pier Caps, and UHPFRC/UHPC superstructure systems including U-Girders, I-Girders, and Strutted Box Girders shall be designed for live loads in accordance with the latest edition of IRC:6 and other relevant IRC/MoRTH provisions applicable for urban elevated corridors and interchange structures.

b. Wind Forces

Wind loads shall be considered in accordance with the latest edition of IRC:6, IS:875, and other relevant standards. Wind effects on the superstructure, substructure, portal frames, barriers, noise barriers (if any), lighting poles, signage gantries, utilities, and all exposed structural elements shall be duly considered in the design. Wind loads on lighting poles generally of 9 m height at approximately 25 m spacing or as per approved layout shall also be considered.

c. Seismic Forces

The Elevated Corridor and associated structures shall be designed for seismic forces in accordance with the latest provisions of IRC:6, IS:1893, IRC:SP:114, and other applicable seismic design standards considering the importance and urban criticality of the structure.

d. Earth Pressure

i. Soil properties for embankments, retaining structures, approach portions, reinforced earth structures, and foundations shall conform to MoRTH Specifications and approved geotechnical investigation reports. For preliminary tender purposes, embankment soil properties may generally be considered with dry density of 1.85 t/cum, saturated density of 2.0 t/cum, angle of internal friction (Φ) = 30°, and cohesion (C) = 0, unless otherwise specified.

ii. Saturated density of backfill material, not less than 2.0 t/cum or as determined through approved geotechnical investigations, shall be considered for computation of active earth pressure and stability analysis.

e. Temperature Effects

i. The design of UHPFRC/UHPC superstructures, PSC pier caps, portal frames, bearings, expansion joints, and associated structural components shall consider temperature effects in accordance with IRC:6, IRC:112, and relevant international recommendations applicable to UHPFRC/UHPC structures. For preliminary design purposes, the temperature variation ("t") may generally be considered as ±17°C or as required under applicable standards and local climatic conditions.

ii. Temperature gradients across deck depth, differential thermal effects, creep, shrinkage, prestress losses, restraint effects, and long-term deformation characteristics of UHPFRC/UHPC and PSC components shall be considered appropriately in the structural analysis and design. Suitable reduced modulus values accounting for creep and long-term thermal strain effects may be adopted in accordance with applicable IRC/IS provisions and approved engineering practice.

2.8.6 Durability

a. Minimum Grade of Concrete shall be as below.

PCC for Levelling Course	M15
RCC for Open Foundation, and Sub Structure and Super Structure	M35
RCC for Super Structure	M45
RCC for Pile and Pile Cap	M35
Prestressed Concrete	M45

b. **Minimum Cement Content, Diameter of Bar and Cover Requirements**
For Plain Cement Concrete (PCC), Reinforced Cement Concrete (RCC) and Pre Stressed Concrete (PSC), the Value given below regarding Minimum Cement Content and Maximum Water Cement Ratio shall be followed.

Plain Concrete		**RCC / PSC**	
Minimum Cement Content Kg / cum.	Maximum Water Cement Ratio	Minimum Cement Content Kg / cum.	Maximum Water Cement Ratio
240	**0.45**	**420/440**	**0.45 / 0.40**

c. The Minimum Nominal Diameter of Reinforcement shall be 8mm.

d. The Minimum Clear Cover to Reinforcement for all Grades of Concrete shall be as below.

Structural Element	**Clear Cover**
Slab	40mm
Web / Column	40mm
Footing / Raft slab	75mm
Cable Duct	75mm
Pile Foundation	75mm

2.8.7 Foundation

Foundation Planning and Design:
Foundation system for the proposed Elevated Corridor, elevated rotary/interchange structures, portal frame locations, second-level carriageway portions, RE wall approaches, and associated structures along Sirsi Circle to Nayandahalli on Mysuru Road corridor shall be designed based on detailed geotechnical investigations, utility constraints, traffic management requirements, construction feasibility, and site conditions. In general, deep foundations such as bored cast-in-situ piles are proposed considering dense urban conditions, existing utilities, restricted working space, multi-level structures, and requirement of longer span UHPFRC superstructures. However, wherever feasible and technically suitable based on bearing capacity, site constraints, and approval of the Employer, open foundations may also be considered for approach structures and ancillary works. The Contractor shall optimize the foundation system to suit the approved concept alignment, construction methodology, safety requirements, and project completion schedule.

a. **General**

The proposed Elevated Corridor alignment from Sirsi Circle to Nayandahalli Junction traverses through dense urban corridors having mixed strata conditions comprising stiff to hard non-cohesive soil with localized rock formations at varying depths. Based on the preliminary geotechnical investigations carried out at Trial Bore Holes No. 1 to 10, the anticipated founding depth for pile foundations generally varies from about 16 m to 25 m below ground level for 1200 mm diameter bored cast-in-situ piles, with estimated safe axial load carrying capacity of about 580 Tons per pile. The allowable Safe Bearing Capacity (SBC) of soil strata for open foundation locations is generally observed in the range of 200 T/sq.m to 250 T/sq.m subject to detailed site-specific investigations.

Considering the dense urban traffic conditions, restricted working space, utility congestion, multi-level elevated structures, portal frame locations, elevated rotary/interchange portions, second-level carriageway integration, and requirement of longer span UHPFRC superstructures, deep foundations are generally proposed for the Project. However, wherever feasible and technically suitable based on detailed geotechnical investigations, site constraints, structural requirements, and approval of the Employer, open foundations may also be considered for approach structures and ancillary portions.

The pile foundations shall generally be of bored cast-in-situ type conforming to relevant provisions of IS:2911 and other applicable IRC/BIS standards, including socketing into suitable hard strata/rock wherever required based on design and investigation results. Final foundation system, founding levels, pile capacities, and design parameters shall be established by the Contractor based on detailed geotechnical investigations and approved design calculations.

b. **Quality of Concrete for Piles, Pile Caps and Foundation Components:**

The minimum grade of concrete for bored cast-in-situ pile foundations shall be M35 or higher as required by design, conforming to relevant IRC, IS and MoRTH Specifications. Concrete for pile caps, foundations, PSC pier caps, piers and other substructure components shall be of grades specified in the approved design and Contract Documents. Minimum cement content, water-cement ratio, durability requirements, admixtures, workability, chloride permeability, curing and quality control parameters shall conform to applicable IRC/BIS provisions and approved mix designs. Coarse aggregates, fine aggregates, water, cementitious materials, admixtures and all other constituents of concrete shall comply with relevant Specifications and approved quality standards for durable urban elevated corridor structures.

c. **Length and Diameter of Piles:**

The pile foundations for the Elevated Corridor, elevated rotary/interchange structures, portal frames, second-level carriageway portions and associated structures shall generally consist of bored cast-in-situ reinforced concrete piles conforming to IRC:78, IS:2911 (All Parts), relevant IRC/BIS Codes and approved design requirements. The piles shall be designed based on detailed geotechnical investigations, structural loading, settlement criteria, lateral load requirements and site conditions. The proposed pile diameter shall generally be 1200 mm for main corridor structures, elevated rotary/interchange portions, portal frame structures and wider carriageway sections, whereas 1000 mm diameter piles may be considered for narrower carriageway portions such as 8.5 m wide corridors and approach structures, or as required by approved design and site conditions.

Piles shall derive load carrying capacity through end bearing and/or skin friction depending upon the soil strata encountered and design assumptions established through detailed investigations. Wherever required, piles shall be socketed into hard strata/rock in accordance with IRC:78 and IS:2911 recommendations. Presence of hard strata/rock shall be established through bore log data, SPT values, rock core recovery, chiselling records and other approved geotechnical investigation methods. Necessary tests including initial load tests, routine load tests, integrity tests and other quality assurance tests shall be carried out as per relevant Codes and Specifications at no extra cost to the Employer.

Temporary casing, bentonite/polymer slurry stabilization, chiselling tools, rock augers, casing oscillators and other suitable boring arrangements shall be deployed wherever required to maintain stability of boreholes and to facilitate safe execution in dense urban conditions. The minimum embedment/socket length, founding level

and termination criteria of piles shall be finalized based on detailed design calculations, test results, geotechnical recommendations and approval of the Employer/Authority Engineer.

Pile Diameters: Piles of minimum 1000mm dia or above shall be used for the Flyovers.

i. **Boring**
Boring Equipment and Accessories shall generally conform to IS: 2911 (Part I / Section – 2). Boring may be done by either Rotary or Percussion Equipment. In case of Unstable Soils, the Boring Tools used shall be such that Suction Efforts are minimised. Stabilization of the Sides of the Boreholes shall be done by the use of Bentonite Slurry or Casing. The Size of the Cutting Tool shall not be less than the Diameter of the Pile by more than 75 mm.

ii. **Drilling Mud**
The Drilling Mud shall be used at least from the Level of Subsoil Water or from the Level of Bottom of Guide Casing depending upon the Site Conditions and the Hole shall then be always kept almost full with the suspension, which shall preferably be kept in motion. The Density and Composition of the Suspension shall be such that to suit the Requirements of the Ground Condition and to maintain the Fine Materials from the Boring in Suspension. A 5% Bentonite Suspension would be generally suitable and its quality shall conform to the Specification given in Appendix A of IS: 2911 (Part I / Section 2).

iii. **Cleaning of Borehole Bottom**
The Bottom of the Hole shall be cleaned very carefully before Concreting Work is taken up. The Cleaning of the Hole shall be ensured by careful operation either by Flushing with the Fresh Drilling Mud through the bottom of the hole or by Air Lifting Process. To lift the Spoil at Founding Level before Concreting, Borehole shall be agitated by jetting with Fresh Drilling Mud with relatively higher pressure than that used during Boring or Air through Tremie Pipe. While boring by use of Drilling Mud, the Specific Gravity of the Mud Suspension in the vicinity of the bottom of Borehole shall be determined at Suitable Interval and Record. Consistency of the Drilling Mud Suspension shall be controlled throughout the Boring and during Concreting Operation, in order to keep the Hole stabilised as well as to avoid Settlement of the Mud.

d. **Founding Level for Piers / Abutments**
The Technical Proposal / GAD shall indicate Founding Level at each Pier / Abutment Location. The Turnkey offer shall include for possibility of Cost of Variation if any between the Actual Founding Level and the Founding Level considered for the Purpose of Bidding. No Extra Payment shall be made in this regard after Finalization of the Turnkey Contract Price.

e. **Ramp / Retaining Walls**
The Solid Ramp Portion of the Flyovers shall be constructed with Reinforced Earth Retaining Structure or RC Retaining Wall designed aesthetically. The Abutments and Returns shall be designed for Live Load Surcharge equivalent to Earth Fill of 1.2m height respectively. The Minimum Density of Filling for Calculations of Surcharge Pressure shall be 2 t / cum. The Surcharge Effect shall be considered for the Purpose of Evaluating Earth Pressure only and not for Vertical Loads.

f. **Pile Foundation**

i. Only Bored Cast – in – Situ Piles shall be accepted.

ii. The Pile Foundations shall be designed as per the Requirements of IS: 2911 (Part I/Section 2) (Latest Edition).

iii. The Contractor shall carry out the Initial Pile Load Test at his own expense. The Design Capacity assumed for the Piles shall be verified by the Initial Load Testing of Test Piles in non working areas, in the vicinity of the Flyovers Site. These Piles shall be tested for 2.5 times the Design Load. Additional Two Piles for each diameter, which are actually going to be used for Piers and Abutments, shall be tested for 1.5 times the Design Load. Minimum Number of both these Tests to be carried out for each Diameter of Pile shall be two (2) each. The Contractor shall carry out the Pile Load Tests as per the Amendments to Existing Methodology of Pile Load Testing by the Task Force for Quality Assurance in Public Construction dated 22 – 10 – 2011 and IS: 2911 (Part 4).

iv. Annular Piles filled or unfilled shall not be accepted.

v. Design with Single Row of Piles shall not be accepted.

vi. Design shall ensure that no Pile is subjected to Tension.

vii. Concreting shall be done, by Tremie Method after ensuring proper Tip Zone Cleaning by Flushing only.

viii. The Top of Concrete in Pile shall be brought above the cut off level by minimum 750mm to permit removal of all Laitance and Weak Concrete before Pile Cap is laid.

a. Open Foundation

Open Foundation may be provided where the foundations can be lied in a stratum which is in erodible and where the strata is hard at shorter depth.

Excavation should be done in such a way that surrounding soil can stand by itself by suitable sloping the sides. When the excavation has to be deep or when the side slopes are not stable, suitable shoring may be provided from top using timber planks, walling piece and struts.

2.8.8 Substructure

a. Dimensions and Structural Requirements

i. The dimensions of substructure elements such as piers, pier caps, portal frame columns, cross beams, pedestals, abutments and retaining structures shall be designed based on structural requirements, durability considerations, architectural appearance, construction methodology and relevant IRC/BIS provisions. However, no structural element thickness shall generally be less than 300 mm or as required by approved design.

ii. Piers for the Elevated Corridor shall generally be of solid RCC/PSC type with aesthetically pleasing shapes such as elliptical, circular, streamlined or architectural forms as approved by the Employer. Portal frame substructures shall be adopted at specified second-level and special crossing locations as indicated in the Concept Plan and approved drawings.

iii. PSC pier caps, hammer head pier caps, portal frame cross beams and bearing pedestals shall be designed to suit UHPFRC U-Girders, I-Girders and strutted box girders, considering erection methodology, future maintenance accessibility, structural stability and serviceability requirements. The height of pedestals supporting bearings shall generally be minimized consistent with design requirements.

b. Layout and Design Requirements

i. Bearings shall preferably be supported directly over pier stems/pier caps and shall be designed considering longitudinal, transverse, torsional and seismic effects arising from curved alignment portions, elevated rotary/interchange structures, portal frame arrangements and second-level carriageway integration.

ii. Dead man anchors, friction slabs or similar arrangements behind abutments for relieving moments shall not be permitted unless specifically approved by the Employer based on detailed design justification.

iii. Adequate provisions shall be made in the design for inspection, maintenance, replacement of bearings, jacking arrangements and future accessibility to all structural components. Locations of lifting/jacking arrangements shall be clearly indicated in drawings and permanently marked on the structure.

iv. Tall piers, portal frame columns and slender substructure elements shall be checked for stability, deflection, vibration, second-order effects and serviceability under all applicable loads including wind, seismic, braking, temperature, erection and construction stage loads in accordance with relevant IRC/BIS Codes.

2.8.9 Superstructure

a. General

The superstructure for the proposed Elevated Corridor shall generally consist of precast/prestressed UHPFRC/UHPC U-Girders, strutted box girders and I-Girders supported over RCC/PSC pier caps, portal frame structures and suitable bearing arrangements. The superstructure system shall be designed considering speed of construction, reduced self-

weight, minimum maintenance, durability, traffic management requirements, curved alignments, elevated rotary/interchange geometry, second-level integration and construction feasibility in dense urban conditions.

b. Strutted Box Girder – 20.2 m Wide Carriageway

For wider carriageway portions including 20.2 m, precast/prestressed UHPFRC strutted box girder sections are proposed. The typical overall depth of strutted box girder shall be about 2.25 m with bottom width about 6.29 m and top width about 6.1 m. The bottom slab thickness shall generally be about 275 mm and web thickness about 225 mm or as required by approved design. Internal cross struts of approximately 100 mm thickness and external projected struts of about 250 mm thickness integrated with deck slab arrangement shall be provided to improve torsional rigidity, transverse stability and structural efficiency. End diaphragms and intermediate diaphragms shall be provided as required by design.

c. UHPFRC U-Girders – 8.5 m Carriageway

For 8.5 m wide carriageway portions, single precast/prestressed UHPFRC U-Girder sections are proposed. The typical girder section shall have bottom width about 2.95 m, overall depth about 2.20 m, web thickness about 200 mm and top width about 4.0 m or as required by approved design. A 50 mm thick UHPFRC plate shall be provided to support the deck slab of approximately 280 mm thickness. Prestressing shall generally be carried out using 15.2 mm diameter low relaxation HT strands conforming to relevant IRC/IS Specifications. Suitable end diaphragms, intermediate diaphragms and structural stiffening arrangements shall be provided.

d. UHPFRC I-Girders for Portal Frame Structures

UHPFRC prestressed I-Girders are proposed for portal frame structures, second-level carriageway portions and special crossing locations to facilitate rapid construction under restricted urban traffic conditions. The typical girder configurations shall generally be as follows or as modified by approved design:

i. For 20 m Span:

Overall girder depth about 650 mm, top flange width about 500 mm with flange thickness about 135 mm comprising 100 mm straight portion and 35 mm tapered portion. Web thickness shall generally be about 125 mm with web depth about 290 mm. Bottom flange shall generally have top width about 125 mm, bottom width about 450 mm and thickness about 225 mm comprising 150 mm straight portion and 75 mm tapered portion.

ii. For 30 m to 35 m Span:

Overall girder depth about 1250 mm, top flange width about 700 mm with flange thickness about 135 mm comprising 100 mm straight portion and 35 mm tapered portion. Web thickness shall generally be about 125 mm with web depth about 890 mm. Bottom flange shall generally have top width about 125 mm, bottom width about 600 mm and thickness about 225 mm comprising 150 mm straight portion and 75 mm tapered portion.

iii. For 40 m to 45 m Span:

Overall girder depth about 1400 mm, top flange width about 600 mm with flange thickness about 135 mm comprising 100 mm straight portion and 35 mm tapered portion. Web thickness shall generally be about 125 mm with web depth about 1040 mm. Bottom flange shall generally have top width about 125 mm, bottom width about 650 mm and thickness about 225 mm comprising 150 mm straight portion and 75 mm tapered portion.

The above girder sections are indicative conceptual configurations prepared for tender purposes. Final dimensions, prestressing requirements, reinforcement detailing, diaphragms and structural arrangements shall be established through detailed design, proof checking and approval process.

e. Prestressing and Structural Requirements

i. Prestressing strands shall generally consist of low relaxation HT strands of 15.2 mm diameter conforming to IS:14268 and relevant IRC provisions unless otherwise approved by the Employer.

ii. The superstructure shall be analyzed and designed for dead loads, live loads, impact, braking forces, temperature effects, creep, shrinkage, wind, seismic effects, torsion, construction stage loads and differential settlements in accordance with IRC:6, IRC:18, IRC:112 and other applicable Codes.

iii. The superstructure system shall adequately cater for torsional effects arising from curved alignments, elevated

rotary/interchange portions, portal frame structures and second-level integration arrangements.

iv. End diaphragms, intermediate diaphragms, cross beams, bearings and expansion joint systems shall be designed considering structural integrity, durability, maintenance accessibility and erection methodology.

f. Precast Construction and Erection

i. Precast UHPFRC/UHPC girders and structural elements shall be manufactured in approved casting yards under controlled quality conditions with suitable moulds, stressing beds, curing systems, handling arrangements and quality assurance procedures.

ii. All girders and precast elements shall be designed for handling, transportation, lifting, launching and erection stresses. Suitable lifting points, orientation marks and identification systems shall be clearly indicated.

iii. Launching and erection methodology shall be planned considering restricted urban working conditions, traffic management requirements, utility constraints, railway crossings, metro integration and safety provisions.

iv. The Contractor shall establish suitable quality control procedures for UHPFRC/UHPC production, casting, curing, prestressing, testing, transportation and erection conforming to approved specifications and recommendations of specialized consultants/proof checking agencies.

2.8.10 Bearings below Superstructure

Bearings for the Elevated Corridor superstructure shall be designed and provided to suit UHPFRC/UHPC U-Girders, strutted box girders, I-Girders, portal frame structures, elevated rotary/interchange portions and second-level carriageway arrangements. Bearings shall generally be located below diaphragms, cross beams or designated support zones and shall preferably remain within the external limits of pier caps, portal frames or supporting substructure elements.

a. Type of Bearings

The type of bearings shall be selected based on span length, structural configuration, torsional effects, seismic considerations, curvature of alignment, rotational requirements and approved design criteria. The generally proposed bearing arrangements are as follows:

Span Range / Structural Arrangement	Proposed Bearing Type
Effective spans up to about 18 m	Elastomeric Bearings
Effective spans above 18 m Curved spans, elevated rotary/interchange	POT/PTFE Bearings or Spherical Bearings
Structures and torsion-sensitive locations	Spherical Bearings / Guided POT-PTFE Bearings
Portal frame and special integral arrangements	Bearings/Integral arrangements as per approved design

b. Accessibility and Maintenance

All bearings shall be properly accessible for inspection, maintenance, replacement and future monitoring without affecting traffic safety and structural stability.

c. Provision for Future Replacement

The design of superstructure, pier caps and bearing arrangements shall include suitable provisions for lifting/jacking of superstructure for future replacement, maintenance or inspection of bearings. Necessary jacking locations and lifting arrangements shall be clearly indicated in approved drawings.

d. Inspection and Quality Control

All bearings shall conform to relevant IRC Codes, MoRTH Specifications and applicable BIS standards. Bearings shall be manufactured, tested and inspected by approved agencies/manufacturers. Necessary quality certificates, inspection reports and test certificates shall be submitted by the Contractor at no extra cost to the Employer.

e. Structural Requirements

The dimensions of bearing plates, seating arrangements and contact surfaces shall be designed to safely transfer all vertical, longitudinal, transverse, torsional and seismic forces from the superstructure to substructure with adequate edge distance, stability and durability requirements as per approved design and relevant Codes

2.8.11 Expansion Joints

The Superstructure shall be designed with minimum feasible expansion joints to ensure smooth, safe, low-noise and uninterrupted riding quality for vehicular traffic. Expansion joints shall be provided only at structurally essential locations considering span arrangement, temperature effects, creep, shrinkage, seismic effects, staged construction requirements and overall structural behaviour of the Elevated Corridor, elevated rotary/interchange structures and second-level carriageway portions.

Modern joint systems such as Modular Strip Seal Expansion Joints, Strip Seal Expansion Joints, Link Slab arrangements, Integral/Semi-Integral Deck Systems, or equivalent approved technologies conforming to relevant IRC Codes and MoRTH Specifications shall be adopted to achieve improved riding comfort, water tightness, durability, reduced vibration and noise levels, minimum maintenance requirements and enhanced service life.

Conventional expansion joints causing excessive noise, leakage, vibration, riding discomfort or frequent maintenance shall not be permitted unless specifically approved by the Employer/Engineer-in-Charge.

Elastomeric Strip Seal Expansion Joints conforming to Clause 2607 of MoRTH Specifications or approved equivalent systems shall generally be adopted wherever expansion joints are required. The Contractor shall submit detailed design calculations indicating adequacy of movement range, gap requirements, temperature movement, rotational capacity and structural compatibility of the selected joint system along with manufacturer's technical details, installation methodology and maintenance requirements for approval.

Installation of expansion joints shall be carried out under the supervision of the manufacturer's authorized engineer/specialist including thermal presetting, alignment control, watertight sealing and quality assurance procedures wherever required.

2.8.12 Crash Barrier.

Concrete crash barriers shall conform to relevant provisions of IRC:5, IRC:112, Clause 809 of MoRTH Specifications and applicable Ministry Circulars including MoRT&H Circular No. RW/NH-33022/1/94-DO dated 24.06.1994. The crash barrier section proposed in the Project is generally based on IRC standard profile with an approximate concrete sectional area of 0.25 Sq.m per running metre or as required by approved structural design.

The Contractor may propose equivalent or improved crash barrier systems conforming to relevant IRC/MoRTH standards subject to approval of the Employer. Suitable hand railing arrangement using 50 mm diameter MS tube or approved equivalent section shall be provided above the crash barrier wherever required for safety, maintenance access and pedestrian protection. Connections shall preferably be bolted or mechanically fixed and field welding shall generally not be permitted unless specifically approved.

Crash barriers shall be designed considering vehicular impact loads, durability, riding safety, aesthetics, drainage requirements and integration with lighting poles, noise barriers, utility provisions and elevated corridor architectural features. Provision for Employer's emblem/logo shall be incorporated at suitable intervals as approved by the Employer.

2.8.13 Drainage

Drainage of Storm Water collected on the Rotary Flyovers/Elevated Structure is essentially based on
IRC: SP: 42 "Guidelines on Road Drainage"
IRC: SP: 50 "Guidelines on Urban Drainage"

The Drainage Spouts shall conform to Clause 2705 of MoRT&H Specifications. The Tenderer shall indicate the Drainage Spouts and its Disposal to natural Storm Water Drain in the Drawings submitted with the Technical Bid.

The Drainage Spouts shall be connected to a Cast Iron Runner Pipe of diameter not less than 150mm and taken down by Down Take Pipes of suitable diameter through the Pier or at Approved Locations. These Pipes shall be connected to Longitudinal Drains below Surface and the Water finally being disposed off into natural Storm Water Drain using appropriately designed RCC Box Culverts for Crossings.

At Ground Level, Catch Water Drain with GI Gratings at Top shall be provided at each end of the Flyovers. Drainage of Water collected at the Deck Level shall be effectively conveyed to Tertiary Drains at Ground Level through Appropriate Box Culverts across Surface Level Roads. The Drains shall be connected to the nearest natural Storm Water Drain. The Turnkey Cost shall include for all these Items.

The entire System including all Arrangements / Details shall be included in the Cost.

2.8.14 Wearing Coat

A 50 mm thick Stone Matrix Asphalt (SMA) wearing course shall be provided over a 3 mm thick waterproofing membrane system on the deck slab/superstructure to ensure durable, skid-resistant, smooth and waterproof riding surface for vehicular traffic. The waterproofing membrane and SMA wearing course shall conform to relevant provisions of MoRTH Specifications, IRC guidelines and approved material specifications.

The wearing course system shall be designed and executed to provide proper drainage, riding comfort, crack resistance, durability, prevention of water ingress into structural components and minimum maintenance requirements under dense urban traffic conditions.

The cross sections, carriageway widths, deck arrangements and wearing course details indicated in Drawing Nos. SSP/DWG/PRJ/2025-26/18-10-1 to 8 for the Elevated Corridor, elevated rotary/interchange structures, portal frame portions and associated approaches shall be generally adhered to unless otherwise modified and approved during detailed design.

2.8.15 Approach Slab

The Approach Slab shall conform to Clause 2704 of MoRT&H Standard Specifications for Road and Bridge Works (Latest Edition).

2.8.16 Electrical Works and Illumination

The Contractor shall include in the EPC scope the complete design, supply, installation, testing and commissioning of street lighting, architectural illumination, electrical utility integration and associated electrical works for the Elevated Corridor, elevated rotary/interchange structures, second-level carriageway portions, portal frame structures, under-deck areas, approach roads and junction improvement locations.

The lighting system shall be designed in accordance with relevant IS Codes, IRC Guidelines, CEA Regulations, BESCOM requirements and applicable MoRTH Specifications. The Contractor shall submit detailed lighting layouts, illumination calculations, power load requirements, feeder arrangements, cable routing, earthing systems and energy-efficient lighting proposals along with detailed design submissions for approval.

LED-based energy efficient lighting systems with suitable poles, brackets, control panels, junction boxes, cabling, earthing, lightning protection and maintenance access arrangements shall generally be adopted. The illumination level shall be designed to achieve safe and uniform visibility for vehicular movement, pedestrian safety, traffic guidance and under-structure usability, generally maintaining average illumination levels of about 40 lux or as required by relevant standards and approved design criteria.

The Contractor shall also coordinate with all concerned utility agencies for power supply arrangements, shifting/protection of existing electrical utilities and integration with existing street lighting systems within the project limits.

2.8.17 Integrity Test

Low Strain Integrity Test shall be carried out for all the Piles in conformation to ASTM D 5882 from an Empanelled Consultant in the Ministry of Shipping, Road, Transport & Highways. The Tenderer shall include the Cost of Conducting this Test in his EPC Tender.

2.8.18 Painting and Protective Coating System

Protective painting/coating systems with approved colour, shade, make and specifications shall be provided for various structural and architectural elements of the Elevated Corridor Project to ensure durability, aesthetics, weather resistance and minimum maintenance under urban environmental conditions.

Sl. No.	Structural Element	Protective Coating / Painting System
1	UHPFRC/UHPC Girders, PSC Pier Caps, Piers, Portal Frames, Viaducts, RE Wall Panels and RCC/PSC Structural Components	Anti-carbonation protective coating/approved concrete protection system conforming to relevant IRC/MoRTH Specifications and approved manufacturer recommendations**.**
2	Structural steel inserts, embedded steel components, utility brackets, railings, ladders and exposed fabricated steel items	Two coats of approved epoxy paint over compatible zinc-rich/epoxy primer system after proper surface preparation.
3	Kerbs, medians, parapets, footpaths, utility ducts, guard rails, grills and other miscellaneous MS items	Two coats of approved enamel/epoxy paint over suitable primer system as approved by the Engineer-in-Charge.
4	MS Hand Rails over crash barriers and maintenance walkways	Two coats of epoxy/polyurethane paint over compatible primer after proper surface cleaning and approved surface preparation method.
5	Exposed surfaces requiring architectural/aesthetic treatment	Texture coating, anti-graffiti coating, decorative finish or approved architectural protective system as specified in approved drawings/design documents.

All painting and protective coating works shall conform to relevant IRC, MoRTH, IS Specifications and approved quality standards. Surface preparation, curing, application methodology, dry film thickness, durability requirements and quality assurance procedures shall be carried out strictly as per approved manufacturer specifications and project requirements.

2.8.19 Specialized Agency for Design and Manufacture of UHPFRC Girders

Considering the specialized nature of Ultra-High Performance Fibre Reinforced Concrete (UHPFRC) girders proposed for the elevated corridor, the successful Contractor shall engage a competent and experienced specialized agency/sub-contractor for the detailed design, design support, manufacture, quality control, testing, transportation, erection support, and implementation of UHPFRC girder works. The proposed agency shall possess demonstrated technical knowledge and capability in UHPFRC/UHPC technology, including material design, structural design principles, prestressing systems, production methodology, curing requirements, durability provisions, quality assurance procedures, handling, transportation, and erection of UHPFRC structural elements. Appointment of such agency shall be subject to the approval of the Employer/Engineer-in-Charge.

The specialized agency shall have qualified structural engineers and technical personnel familiar with the design philosophy, codal requirements, international best practices, manufacturing processes, and construction methodologies applicable to UHPFRC structures. Preference shall be given to agencies that have successfully participated in the design, manufacture, supply, erection, or execution of UHPFRC/UHPC girders, precast bridge elements, advanced concrete bridge systems, or similar specialized structural components in Government, Semi-Government, Metro Rail, Railway, National Highway, State Highway, Urban Infrastructure, or other public infrastructure projects. The Contractor shall submit documentary evidence such as work orders, completion certificates, client certificates, technical approvals, project reports, or other acceptable proof demonstrating the credentials and experience of the proposed agency.

The detailed design of UHPFRC girders and associated structural components shall be carried out in accordance with relevant IRC, IS, international standards, project specifications, and accepted engineering practices applicable to UHPFRC structures. The complete design, methodology, material specifications, quality assurance plan, testing programme, and construction methodology shall be independently reviewed as per the direction of Engineer –in-charge. The specialized agency shall work in close coordination with the design-vetting institution and shall incorporate all observations, recommendations, and modifications required during the design review process. The Contractor shall also establish a comprehensive quality control and quality assurance system for production and construction of UHPFRC girders, including material characterization, trial

mixes, prototype testing, production testing, durability assessment, and performance validation, as directed by the Employer and the design-vetting institution.

Notwithstanding the engagement of any specialized agency or the acceptance of any design by the Employer or the design-vetting institution, the Contractor shall remain fully responsible for the structural adequacy, durability, quality, safety, performance, and successful completion of all UHPFRC girder works under the Contract.

2.9 Load Testing

a. General Requirements

i. Before commencement of production works and foundation execution, the Contractor shall, at his own cost and risk, carry out initial load tests, routine load tests, lateral load tests and integrity tests on pile foundations for the Elevated Corridor, elevated rotary/interchange structures, portal frame locations, second-level carriageway portions and associated structures in accordance with relevant provisions of IRC:78, IS:2911, IRC:SP:114, IRC:SP:84 and other applicable IRC/BIS Codes and Specifications.

ii. In addition to pile testing, wherever the Employer/Authority Engineer considers any structural system, UHPFRC/UHPC girder configuration, portal frame arrangement, special span, rotary structure, curved segment, erection methodology or structural component to be of special or unusual nature, the Contractor shall carry out prototype testing, proof load testing, model studies, field performance testing, mock-up trials or structural behaviour studies as directed by the Employer.

b. Pile and Foundation Testing

i. Initial load tests shall generally be carried out on designated test piles to establish safe axial load capacity, lateral resistance, settlement characteristics and design assumptions.

ii. Routine load tests, pile integrity tests, cross-hole sonic logging tests or equivalent approved non-destructive tests shall be carried out on working piles as specified in relevant Codes and approved quality assurance plans.

iii. The Contractor shall submit detailed test procedures, instrumentation details, loading arrangements, interpretation methodology and test reports for approval.

c. Superstructure and Structural Load Testing

i. If required by the Employer/Authority Engineer, the Contractor shall carry out load testing on any portion of the superstructure including UHPFRC/UHPC U-Girders, strutted box girders, I-Girders, portal frames, elevated loop structures, second-level carriageway structures or completed spans to verify structural behaviour, deflection, vibration characteristics, stability and performance under design loading conditions.

ii. The load test methodology shall conform to relevant IRC Codes including IRC:SP:51, IRC:SP:37, IRC:112 and other applicable standards/guidelines.

d. Circumstances Requiring Testing

The Employer may instruct additional testing or proof checking in the following situations:

i. Failure of concrete cubes/specimens or non-conformance with specified strength/performance requirements.
ii. Premature removal of formwork, supports or staging.
iii. Improper curing, casting defects or construction deficiencies.
iv. Doubts regarding structural integrity, workmanship, geometry control or material quality.
v. Introduction of modified structural systems, revised erection methodology or altered construction sequence.
vi. Verification of behaviour of UHPFRC/UHPC structural components, joints, diaphragms or special structural arrangements.

e. Cost of Testing

i. All mandatory tests specified under IRC/IS/MoRTH Specifications, approved Quality Assurance Plans and Contract requirements shall be deemed included in the Contract Price.

ii. Tests ordered due to defective workmanship, material deficiencies, construction negligence or failure to meet specifications shall be carried out entirely at the Contractor's cost.

iii. Where special model studies, proof testing or performance testing are ordered solely for validation of innovative systems or special design requirements and the results are satisfactory, the Employer may consider reimbursement only if specifically approved under Contract provisions.

f. Contractor's Responsibilities

The Contractor shall make all arrangements for testing including:

i. Preparation and submission of detailed test calculations, loading schemes, instrumentation plans and observation procedures.
ii. Deployment of calibrated equipment, reaction systems, kentledge, sensors, monitoring instruments and safety arrangements.
iii. Recording of settlements, strains, deflections, rotations, vibrations, crack behaviour and other structural responses during and after testing.
iv. Submission of complete test reports, analysis and interpretation certified by the Designer/Proof Consultant.

g. Defects and Rectification

Any defects, distress, excessive deflection, cracking, settlement or structural inadequacy observed during testing shall be rectified by the Contractor at his own cost through approved remedial measures, strengthening, redesign or replacement as directed by the Employer/Authority Engineer.

h. Completion of Testing

Upon completion of testing, all temporary loading arrangements, kentledge, staging, instrumentation and associated temporary works shall be removed by the Contractor and the structure/site restored to the satisfaction of the Employer.

i. Special Provisions for Prestressed and UHPFRC Structures
ii. Load testing of prestressed/UHPFRC/UHPC superstructure components shall consider temperature variations, creep, shrinkage, prestress losses, construction stage effects and time-dependent behaviour. Necessary corrections and monitoring provisions shall be incorporated while evaluating test results in accordance with relevant IRC recommendations and approved proof checking procedures

2.10 Slip Roads, other Surface Level Roads, Culverts and Junction Improvements

The Work of **Approach Road i.e. Solid Ramp Portion** to be carried out under this Contract. The Total Scope of Road work is 2100 m considering both side.as per followings:

a. Construction of **Approach Road i.e Solid Ramp Portion** including Dismantling of Existing Structures coming on the Carriageway such as Govt. Buildings, Compound, Drains, Footpaths, Kerbs, Medians, Parapet Walls; Construction/widening of Culverts/Box culverts; etc

- Slip Roads beyond the Lengths of the approaches to Elevated Rotary Ramps are to be merged with Existing Roads through a Taper / Transition of 1 in 15.

b. Construction of Medians; Kerbs, Footpath, Storm Water Drains with Drain Cover Slabs where ever missed and necessary, Traffic Signages, Overhead Gantry, Road Marking such as Lane Marking, Pedestrian Marking, Direction Marking, STOP and STOP Lines, etc. as per the Specifications given MoRT&H and Kerb Painting as per the Specifications mentioned in this Tender Document.

c. The Construction of Medians, Kerbs and Footpath shall conform to Clause 407, 408 and 409 of the MoRT&H Specifications for Road and Bridge Works (Latest Edition).

d. Dismantling of Existing Road Over Bridge at IOC Junction with down ramp loop, etc. and reconstruction with Elevated Rotary with approaches as per the structural design mentioned above section 2.8.

2.11 Submission of Elevated Corridor/Rotary design Reports for approval

After award of work, Successful Tenderer shall submit the following design reports for Approval

1. Design basis report of the bridge stating the salient features of bridge, i.e span, skew angle span arrangements, longitudinal eccentrics, depth of girders, type of superstructure UHPFRC/STEEL, R.C.C., PSC, composite, type of bearings arrangement with sketch showing fixed/free ends, curvature if any and the details of parameters codes, load combinations cases, wind, seismic zone etc. For drawings of non-standard span of Railways must duly proof checked as per the direction of Engineer –in-charge.

2. Soil report of the railway bridge site with bore hole at each railway pier and abutment location and also shown on sketch showing the bore holes locations w.r.t to pier/abutment positions. The recommendations of the soil consultant for the open foundation/pile foundation if applicable clearly stating the pile length with safe loads for two three alternates.

3. The feasibility of the structure or components must be checked in all respects by the tenderer before submitting the design to Railway/ B-SMILE office and signed by the authorized signatories of Tenderer.

4. The drawing must be submitted in preferably A-I size only in prescribed/standard format.

5. The design/drawing of the test pile is to be submitted if applicable for the approval as per the codal provisions duly proof checked as per the direction of Engineer –in-charge.
6. The software/staad files hard copy as well as soft copy must be submitted with the design note used in design for help in checking the design.

7. PSC Superstructure has to be as per IRC-112, Composite Superstructure has to as per IRC-24

8. Stress summary should be prepared for each component of the bridge i.e. pile or open foundation as applicable, pile cap/foundation slab and beam, pier, pie cap, stating the actual stresses vs permissible stresses or steel provided vs steel required.

9. A certificate from the proof checking agency on successful Tenderer letter head stating that the design and drawing of the bridge has been checked by me and found in order as per the latest IRC codal provisions.

2.12 Safety precautions and measures to be observed during execution of Elevated Rotary works in Project road and Adjoining areas

The works required to be done under traffic block protection, are to be carried out only in the presence of Traffic Police officials. The Traffic supervisor has to certify safe conditions for passage of main traffic. Following important activities of works shall be carried out under supervision of Traffic nominated Supervisor

a) Excavation at foundation/Ground level near to Road Median.

b) Concrete casting and/or masonry very close to Road Median.

c) Erection of temporary structures near to running lines.

d) Casting of structures like girder/slab over Pier cap/Portal frame.

e) Stage-Pre-stressing of girders when placed across Pier cap properly supported.

f) Launching of precast/pre-assembled girders across Road.

g) Any work of lifting, side shifting and slewing of girders over the Traffic road.

h) Dismantling of temporary structures, shutters, scaffolding etc. adjacent to the Project Road.

i) For carrying out activities of casting, erection, launching, handling and dismantling as listed above, the Contractor's Engineering shall furnish the Construction Programme in advance to Traffic Police. No such work should be taken up in absence of the Supervising Traffic police inspectors. For the activities which are to be done in presence of the Traffic police, prior intimation shall be given in writing and acknowledgement obtained from Traffic representative. Such activities of work shall not be carried without the presence of Traffic police.

2.13 **Traffic Diversion and Traffic Management during Construction**

The Contractor shall design, plan, construct, operate, maintain, modify and remove all Temporary Traffic Diversion Arrangements, Traffic Management Systems and Construction Stage Traffic Circulation Plans required for execution of the "Construction of Proposed Elevated Corridor from Sirsi Circle to Nayandahalli on Mysuru Road (Length approximately 5.2 km) in Bengaluru City".

The Contractor shall ensure safe, continuous and uninterrupted movement of public traffic, BMTC buses, emergency vehicles, pedestrian traffic, utility access and access to adjoining commercial, residential and institutional properties throughout the construction period. The Contractor shall prepare detailed Traffic Diversion Plans, Stage-wise Construction Methodology, Barricading Layouts, Temporary Road Layouts, Signage Plans, Lane Closure Proposals, Temporary Junction Improvement Plans and Traffic Safety Arrangements in coordination with Bengaluru Traffic Police, BMRCL, Utility Agencies and other concerned Authorities.

The traffic diversion arrangements may include temporary service roads, phased lane closures, one-way traffic circulation systems, utilization of existing parallel roads, temporary widening of carriageways, temporary median openings, signal modifications, night-time construction operations, temporary junction channelization, temporary steel plate crossings, pedestrian management arrangements and other traffic engineering measures as required depending upon site conditions and construction stages.

Indicative diversion corridors and traffic redistribution routes may include:

Sirsi Circle – Chamarajpet – Mysuru Road parallel stretches,
Vijayanagara – Gopalan Mall – Gali Anjaneya Temple Junction corridor,
Service roads and parallel local roads along Mysuru Road,
Nayandahalli Junction connectivity roads,
Other interconnected urban roads and alternative routes as approved by Bengaluru Traffic Police and the Engineer-in-Charge.

The Contractor shall specifically plan and manage traffic diversion arrangements near major junctions including Sirsi Circle, Vijayanagara Junction, Gopalan Mall Junction, Gali Anjaneya Temple Junction and Nayandahalli Junction, considering the proposed split elevated carriageways, loop ramps, portal frame structures, cantilever pier arrangements and integration with existing flyovers and metro infrastructure.

The Traffic Diversion Drawings, if enclosed in the Tender Documents, are only indicative and intended to broadly indicate the scope and traffic management philosophy. The Contractor shall carry out detailed traffic studies, traffic volume assessments, queue length analysis, simulation studies, turning movement studies and intersection management studies and shall prepare final stage-wise traffic diversion proposals suitable to actual site conditions and construction methodology.

Before commencement of any work affecting existing traffic movement, the Contractor shall prepare detailed diversion proposals in consultation with the Employer/Engineer-in-Charge and submit the same for approval by Bengaluru Traffic Police and other concerned Authorities. The Contractor shall also make necessary arrangements for public notification, cautionary information systems and traffic awareness measures wherever required.

The Contractor shall provide, install, operate and maintain all necessary traffic safety devices including barricades, retro-reflective signage, blinkers, delineators, traffic cones, caution boards, diversion boards, speed calming arrangements, temporary lighting, crash barriers, pedestrian protection systems and warning systems in accordance with IRC:SP:55, IRC:67, IRC Work Zone Safety Guidelines, MoRT&H Specifications and directions of the Traffic Police and Engineer-in-Charge.

The diversion and construction staging shall be planned in such a manner that inconvenience to the travelling public is minimized to the maximum extent possible and safe movement of traffic is maintained at all times. The Contractor shall ensure proper work zone safety management and regulated movement of construction vehicles, machinery and materials within the Project corridor.

The Contractor shall maintain all existing roads handed over to him in traffic-worthy condition during the entire construction period. The scope shall include rectification of wear and tear, potholes, damaged stretches, temporary

riding surface improvements, drainage maintenance and periodic resurfacing wherever required as directed by the Engineer-in-Charge for smooth movement of diverted traffic.

The Contractor shall also include the cost of temporary and repetitive resurfacing, junction improvements, temporary pavement strengthening, road safety arrangements, traffic marshals and all incidental works necessary for maintaining traffic during the construction period. No separate payment shall be made for Traffic Diversion and Traffic Management arrangements, and the cost thereof shall be deemed to be included in the Contract Price.

All traffic diversion arrangements, temporary works and construction staging shall conform to relevant IRC Codes, MoRT&H Specifications, Bengaluru Traffic Police requirements and instructions issued by the Employer/Engineer-in-Charge from time to time.

2.14 Traffic Signs, Markings and other Road Appurtenances

Traffic Signs, Markings and other Road Appurtenances shall conform to Clause 800 of the MoRT&H Specifications for Road and Bridges (Latest Edition) and shall be shown in the Drawings submitted with the Technical Bid. Road Markings shall conform to IRC: 35 (Latest Revision) and Road Signs shall conform to IRC: 67 (Latest Revision). The Tenderer shall submit the Detailed Drawings of the Signages required as per the relevant IRC Specifications. Overhead Gantry by indicating Destinations as per the Approval of the Employer shall be provided at the Approved Location. Signages shall be provided with Retro Reflective, Micro Prismatic Reflectionised Stickers. Advanced Direction Boards with similar Specifications as above shall be provided at Locations mandated by IRC and as directed by the Employer.

2.15 Drainage System

The Contractor shall carry out Hydraulic Study in the entire Catchment Area, which is having influence on the Battery Limit of the Project, in order to assess the Quantity of Runoff to be drained off from the Battery Limit. For this purpose, the Contractor shall map the Storm Water Drainage System, which passes through the Battery Limit. He shall calculate total Quantity of Runoff, which precipitates on the Battery Limit Area and enters the Battery Limit Area. The Contractor shall work out a Comprehensive Drainage System for Disposal of Runoff collected in the Elevated Rotary/ROB, on Surface Level Road by Gravity Flow only and the Drain shall be connected to the nearest Natural Storm Water Drain and as per the Approval of the Employer.
All Drainage System shall conform to Clause 309 of MoRT&H Specifications for Road and Bridges (Latest Edition).

However, the Levels and Dimension Details for Drainage Arrangement shown in the Drawings are only indicative. The Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study.

The Tenderer shall indicate a Comprehensive Drainage Arrangement System in the Drawings to be submitted at the time of execution.

The Lump Sum Cost quoted by the Tenderer shall include rectification and restoration to the proper drainage work. During the Construction, the Water, which is met with, shall be pumped into the Roadside Drains. At no point it shall be pumped into BWSSB Sewer / Sanitary Lines.

2.16.1 Carriageway Improvement Works

The Works to be carried out under this EPC Contract shall include carriageway improvements, restoration of damaged roads, reconstruction works, junction integration works, slip roads and associated pavement works within the Project influence area as directed by the Employer/Engineer-in-Charge.

i. Improvements to carriageway stretches within the Project limits shall include dismantling/removal of existing damaged black topped/concrete surfaces, disposal of dismantled materials, scarification, excavation, utility restoration and reconstruction of pavement crust comprising subgrade, GSB, WMM, DLC/PQC, bituminous layers or Thin White Topping, as applicable, conforming to relevant MoRTH Specifications and approved pavement composition.

ii. Restoration and reconstruction of existing roads damaged due to pile foundation works, utility shifting, excavation, traffic diversion arrangements, movement of heavy construction equipment and all other construction activities shall be carried out continuously along all pier locations throughout the Elevated Corridor alignment where elevated corridor construction is not proposed but affected due to project-related activities.

iii. The restored roadway shall conform to the same or higher specification, pavement composition, pavement crust thickness and riding quality as the original/existing roadway condition prior to commencement of the Works, as directed by the Engineer-in-Charge.

iv. The scope shall also include new construction of Thin White Topping road works for cumulative length of approximately 1200 m as specified under Clause 1.3(y), including associated drainage arrangements, kerbs, utility integration, footpaths, paver blocks, service/buffer zones, storm water drain arrangements and allied civil works complete in all respects.

v. Providing and applying tack coat/prime coat on prepared bituminous surfaces shall conform to relevant MoRTH Specifications and approved construction methodology.

vi. Providing and fixing precast concrete kerb stones, medians, edge restraints and associated finishing items shall conform to approved drawings and relevant IRC/MoRTH Specifications.

vii. . Road Markings, Road Studs and At-Grade Carriageway Improvements

Road markings using Hot Applied Thermoplastic Compound with reflectorised glass beads shall be provided throughout the entire Project Corridor, including elevated carriageways, slip roads, approach roads, at-grade roads, junction improvement areas, rotary/interchange portions, traffic diversion stretches and all reconstructed carriageway portions within the Project limits, as directed by the Employer/Engineer-in-Charge.

a. Providing and laying Hot Applied Thermoplastic Compound of 2.5 mm thickness, excluding surface-applied glass beads, with reflectorising glass beads at 250 g/sq.m shall conform to IRC:35 (Latest Edition), MoRTH Specifications and approved traffic safety standards. The finished markings shall be uniform, smooth, skid-resistant and free from streaks, waviness and defects.

b. The road markings shall include edge lines near footpaths and medians, lane markings, centre broken lines, stop lines, directional arrows, chevron markings, zebra crossings, channelizers, junction markings, rotary markings, speed regulation markings, hazard markings and all other traffic safety markings required for proper traffic management and integration throughout the Project Corridor.

c. Providing and fixing reflective road studs/raised pavement markers of size 100 mm × 100 mm, die-cast in aluminium or approved equivalent corrosion-resistant material fitted with reflective lenses, shall be carried out along medians, edge lines, lane separators, curves, ramps, junctions and traffic channelization areas in accordance with relevant IRC/MoRTH Specifications and approved traffic safety plans.

d. The Contractor shall carry out carriageway maintenance, rectification and improvement works at grade throughout the Project influence area and within the battery limits, including damaged stretches affected due to construction activities, traffic diversions, utility works and movement of heavy machinery.

e. The scope shall also include asphalt/bituminous pavement restoration and strengthening works, wherever required, including DBM/BC layers, milling, overlaying and patch rectification works conforming to approved pavement composition and MoRTH Specifications. Minimum quantities indicated in the Contract shall be treated as indicative and the Contractor shall execute the required extent of works necessary for proper restoration, riding quality and traffic integration within the Project limits as directed by the Engineer-in-Charge.

2.16.2 Paved Pedestrian Crossing / Footpath and Utility Crossing Works

The Works of providing paved pedestrian crossings, footpath crossings, utility access crossings and associated pedestrian movement facilities under this EPC Contract shall include the following:

i. Scarifying/removal of existing bituminous surface, concrete surface, surface dressing or premix carpet, including collection, stacking and disposal of dismantled/unserviceable materials complete in accordance with MoRTH Specifications and directions of the Engineer-in-Charge.

ii. Providing and applying tack coat/prime coat on prepared bituminous surfaces conforming to relevant

MoRTH Specifications and approved construction methodology.

iii. Providing and laying bituminous concrete/approved wearing surface of required thickness using approved hot mix plant, crushed aggregates, bituminous binder and paving equipment, laid to proper line, grade, camber and level and compacted with suitable rollers to achieve specified density and riding quality in accordance with MoRTH Specifications.

iv. Providing and laying heavy-duty interlocking concrete paver blocks/cobble stones of approved thickness, size, colour and pattern over prepared granular/sand bedding, including edge restraints, joint filling, compaction and finishing complete for pedestrian crossings, footpaths, utility access zones, median openings and traffic channelization areas as directed by the Engineer-in-Charge.

v. Providing and fixing precast RCC slabs/cover slabs for side drains, utility trenches, chambers, crossings, duct covers and pedestrian access locations including reinforcement, formwork, lifting arrangements, finishing, curing and all incidental works complete in accordance with approved drawings and specifications.

vi. The scope shall also include tactile paving, kerb ramps, pedestrian safety features, accessibility provisions, utility coordination, drainage integration and restoration of adjoining surfaces required for safe pedestrian movement within the Project limits.

2.16.3 Pipe Duct / Drainage and Utility Crossing Works

The Works to be carried out under this EPC Contract shall include construction of pipe ducts, utility crossings, storm water drainage arrangements, shoulder drains and associated drainage improvement works within the Project Corridor and influence areas.

i. The scope shall include excavation, laying and construction of RCC pipe ducts/utility crossings across roads at identified locations all along the elevated corridor and other locations as directed by the Engineer-in-Charge, for an approximate cumulative length of 65 m or as required based on site conditions and utility integration requirements.

ii. The works shall include excavation, shoring/dewatering wherever required, providing and laying Plain Cement Concrete bedding of minimum 100 mm thickness, laying of NP3 class RCC Hume pipes of required diameter (generally 300 mm diameter or as approved in design), jointing, encasing/protection works, backfilling and restoration complete in accordance with MoRTH Specifications and approved drawings.

iii. Pipe ducts/drainage lines shall be laid to the required gradient/slope to ensure proper hydraulic flow and integration with existing and proposed storm water drainage systems.

iv. Packing/backfilling around and above the pipes shall be carried out using selected earth/granular material and compacted in layers to achieve the required density and stability as per approved specifications and directions of the Engineer-in-Charge.

v. The Contractor shall also provide shoulder drains, cross drains, catch pits, drainage chambers, utility trenches and associated drainage arrangements at waterlogging and low-lying locations along the Project Corridor to ensure proper surface runoff and prevention of flooding/water stagnation.

vi. The Contractor shall carry out necessary hydraulic studies, drainage investigations, level surveys and utility coordination for finalizing the drainage arrangement, pipe sizes, invert levels, slopes and outfall connectivity. Detailed drawings/designs shall be submitted and approved by the Employer/Engineer-in-Charge prior to execution.

2.16.4 Road Side Existing Drain

The main objective of this Work is to ensure free and uninterrupted flow of storm water collected from the Right of Way (ROW), elevated corridor structures, carriageways, adjoining properties, junction areas and utility corridors

throughout the Project influence area.

The Works to be carried out under this EPC Contract shall include inspection, restoration, improvement, desilting, modification and reconstruction of existing roadside drains/storm water drains within the Project limits and influence areas, irrespective of the quantities indicated elsewhere in the Contract documents including Clause 2.17.10.

The scope of work shall generally include the following:

i. Removal, resetting, replacement and reconstruction of existing drain slabs, cover slabs, side walls, drain edges and damaged drainage components wherever affected due to construction activities or required for proper drainage integration.

ii. Desilting, cleaning and removal of debris, silt, vegetation, obstructions and deposited materials from existing roadside drains/storm water drains for smooth hydraulic flow and prevention of water stagnation/flooding.

iii. Repair, strengthening, widening, deepening, extension or reconstruction of existing drainage arrangements wherever required for proper discharge of storm water from elevated structures, carriageways, slip roads, service roads and adjoining areas.

iv. Integration of existing drains with newly proposed drainage systems, pipe ducts, catch pits, utility crossings and storm water outfalls within the Project Corridor.

v. Restoration of all disturbed drainage portions and surrounding areas complete in all respects as directed by the Engineer-in-Charge.

2.16.4.1 Improvement / Reconstruction of Existing RCC Covered Drain with Precast Slabs

This Work involves maintenance, restoration, strengthening, modification and reconstruction of existing RCC roadside drains retained along the Project Corridor, including construction of new RCC covered drains at missing or deficient locations wherever required for proper storm water management and hydraulic continuity.

The scope generally includes improvement/reconstruction of RCC covered drains of approximate dimensions 1.0 m width × 1.0 m depth or as finalized through approved hydraulic design and site requirements, including precast RCC cover slabs and associated drainage components.

The above Work shall include the following items:

i. Earthwork excavation for new drain portions, widening/deepening of existing drains, dressing of sides and preparation of foundation bed complete as required.

ii. Removal and disposal of disused/damaged materials, debris, silt and obstructed drainage components from existing drains.

iii. Providing and laying PCC bedding/foundation concrete of required grade and thickness conforming to MoRTH Specifications and approved drawings.

iv. Construction, strengthening or reconstruction of RCC drain side walls, base slabs, drain covers, junction chambers and associated RCC components using approved design mix concrete, reinforcement, formwork, dewatering and finishing complete in all respects.

v. Repair/restoration of existing RCC drains and resetting/replacement of damaged drain slabs retained along the Project road wherever affected due to construction activities or where required for proper drainage functioning.

vi. Backfilling and compaction around drain structures with approved earth/granular material in layers to required density.

vii. Providing and fixing precast RCC perforated/solid cover slabs of approved thickness with lifting arrangements, reinforcement and finished surfaces complete in accordance with approved drawings and specifications.

viii. Integration of existing and newly proposed drains with storm water collection systems, rainwater harvesting arrangements, pipe crossings, catch pits and utility drainage systems throughout the Project Corridor including rotary/interchange and second-level structure locations.

Further, the Contractor shall carry out necessary hydraulic studies, drainage investigations and level surveys to finalize the dimensions, invert levels, discharge capacity and connectivity of the drainage system and obtain approval of detailed drainage drawings from the Employer/Engineer-in-Charge prior to execution.

2.17.4 Kerb Works

The Works of providing, fixing, restoring and painting kerb stones at required, damaged, missing and newly developed locations under this EPC Contract shall include the following:

i. Providing and fixing precast solid concrete kerb stones of approved size (generally 600 mm × 300 mm × 150 mm or as approved in drawings), manufactured using design mix concrete of approved grade, including necessary foundation concrete, alignment, jointing, cutting, finishing and all incidental works complete in accordance with MoRTH Specifications and approved drawings.

ii. Kerb stones shall be provided along medians, footpaths, slip roads, junctions, rotary/interchange areas, approach roads, utility zones, traffic islands, divider edges and all other required locations throughout the Project Corridor, including replacement/restoration of damaged kerbs affected during construction activities.

iii. The cumulative minimum kerb length under the Project shall generally be about 8000 m or as required for complete execution of the corridor works and traffic integration requirements.

iv. Painting of kerb stones/medians shall include surface preparation and application of two or more coats of approved synthetic enamel/reflective paint in approved colour combinations conforming to IRC/MoRTH standards for traffic safety and visibility throughout the Project Corridor.

v. The Contractor shall maintain uniform alignment, aesthetics, drainage compatibility and riding safety while executing all kerb and edge restraint works within the Project limits.

2.17.5 Footpath and Pedestrian Facilities

The Works of providing, reconstructing, restoring and improving footpaths/pedestrian facilities, including damaged locations, under this EPC Contract shall include construction of footpaths, pedestrian access zones, utility corridors, buffer areas and associated urban streetscape works for an approximate cumulative area of 5000 sq.m or as required for complete integration within the Project Corridor.

The scope of work shall generally include the following:

i. Earthwork excavation, dressing, preparation and levelling of formation/subgrade for footpath and pedestrian utility zones.

ii. Removal and disposal of disused/damaged materials, debris and unsuitable earth from the work area.

iii. Surface preparation, compaction and provision of suitable granular/sub-base layers as

required for stable pedestrian pavement construction.

iv. Construction of RCC edge beams, side walls, retaining edges, utility trenches, drain edges and associated concrete works using approved grade concrete including reinforcement, shuttering, curing, dewatering and finishing complete in all respects as per approved drawings and specifications.

v. Providing and laying sand bedding/base layer of approved thickness for placement of interlocking paver blocks/cobble stones.

vi. Providing and laying heavy-duty interlocking concrete paver blocks/cobble stones of approved thickness (generally 60 mm or as approved), size, colour and pattern with required compressive strength over prepared bedding layer, including compaction with plate vibrator, joint filling, alignment and finishing complete in accordance with MoRTH Specifications and directions of the Engineer-in-Charge.

vii. Footpath works shall include integration with kerbs, storm water drains, utility chambers, street lighting poles, pedestrian crossings, tactile paving, ramps/accessibility provisions, landscaping interfaces and all incidental works required for safe and continuous pedestrian movement throughout the Project Corridor.

viii. The Contractor shall restore all footpaths, pedestrian pathways and utility access areas damaged during execution of elevated corridor works to equal or improved condition conforming to approved urban road standards and traffic safety requirements.

2.17.6 Illumination and Electrical Works

The Illumination and Electrical Works to be carried out under this EPC Contract shall include design, supply, installation, testing, commissioning, replacement, restoration and maintenance of complete street lighting and illumination systems for the Elevated Corridor, elevated rotary/interchange, second-level carriageway, slip roads, at-grade roads, junctions, footpaths and associated Project areas.

The scope of work shall generally include the following:

❖ Providing, fixing, shifting, replacement and restoration of street lighting poles, high mast poles, brackets, fixtures, luminaires, LED lighting systems and associated electrical components within the Project limits.

i. Providing and laying LT/HT underground cables, HDPE/GI cable ducts, junction boxes, feeder pillars, control panels, earthing systems, electrical chambers and associated electrical infrastructure complete in accordance with relevant IS Codes and approved drawings.

ii. Replacement/restoration of damaged box ducts, cable trenches, electrical utilities, poles, fixtures and associated systems affected during construction activities.

iii. Providing illumination arrangements for elevated carriageways, under-deck areas, rotary/interchange zones, pedestrian areas, utility/service roads and traffic integration zones to achieve safe traffic movement and adequate lighting levels as per relevant IRC/IS standards.

iv. Providing earthing, lightning protection systems, electrical safety arrangements, energy-efficient lighting controls and associated accessories complete in all respects.

v. Painting, finishing and corrosion protection treatment for poles, brackets and exposed electrical components using approved paint systems and protective coatings.

vi. Testing, commissioning, energization and coordination with concerned utility/electrical authorities including obtaining statutory approvals wherever required.

vii. Restoration and integration of existing electrical/illumination systems disturbed during execution of the Project and maintenance of the same during the Contract period as directed by the Engineer-in-Charge

2.17.7 Traffic Signage, Road Safety and Pavement Marking Works

The Traffic Signage, Road Safety and Pavement Marking Works to be carried out under this EPC Contract shall include design, supply, installation, fixing, restoration, testing and maintenance of all traffic safety devices, road signs, guidance systems and pavement marking arrangements throughout the Elevated Corridor Project limits in accordance with IRC, MoRTH and relevant BIS standards.

The scope of work shall generally include the following:

i. Providing and fixing retro-reflective cautionary, mandatory, informatory, directional, overhead gantry, lane guidance, speed regulation, diversion, route identification, junction control and hazard warning signages conforming to IRC:67 (Latest Edition) and relevant MoRTH Specifications.

ii. Sign boards shall generally consist of high-intensity/micro-prismatic retro-reflective sheeting mounted over aluminium composite panels/aluminium sheets of approved thickness and supported on GI/MS posts, gantries, cantilever structures or brackets as approved in design.

iii. Sign supports/posts shall be firmly fixed in properly designed reinforced cement concrete foundations of approved grade and dimensions suitable for wind loading, traffic conditions and structural stability requirements.

iv. The scope shall also include temporary traffic diversion signs, barricading signs, construction zone safety signs, blinkers, delineators, hazard markers, crash cushions, traffic cones and all temporary traffic management systems required during execution of the Project.

v. Providing and laying thermoplastic road markings, lane markings, directional arrows, zebra crossings, edge lines, stop lines, chevron markings, median markings and other pavement markings conforming to IRC:35 and MoRTH Specifications throughout elevated and at-grade portions of the corridor.

vi. Providing and fixing road studs/cat eyes, delineators, reflective markers, median reflectors and associated traffic safety furniture at required locations for safe traffic guidance during day and night conditions.

vii. The Contractor shall ensure integration of traffic signage and road safety arrangements with existing and proposed traffic systems, junction improvements, rotary/interchange portions and pedestrian facilities throughout the Project Corridor.

viii. All signage, pavement markings and road safety systems damaged during construction activities shall be restored/replaced by the Contractor at his own cost and maintained in proper condition during the Contract and maintenance period.

2.17.8 Project Information and Display Boards

The Works under this EPC Contract shall include design, fabrication, supply, installation and maintenance of Project Information Display Boards at prominent and approved locations throughout the Project Corridor as directed by the Employer/Engineer-in-Charge.

i. The display boards shall generally contain details such as name of the Project, name of Employer/Authority, name of Contractor, Contract value, commencement date, completion period, defect liability/maintenance period, traffic advisory information and other particulars as instructed by the Employer.

ii. The boards shall generally be of rectangular shape of approximate size 1.20 m × 0.90 m or such other dimensions as approved by the Employer and shall be fabricated using durable weather-resistant materials with proper supporting arrangements, painting, reflective lettering and foundation works complete in all respects.

iii. The Contractor shall maintain the display boards in proper readable condition throughout the execution

period of the Project and replace damaged/faded boards whenever required.

The cost of all such display boards including fabrication, erection, maintenance, shifting and removal shall be deemed to be included in the quoted Contract Price and no separate payment shall be made on this account.

2.17.9 Project Cost Estimate and Scope Consideration

The Project Cost Estimate has been prepared based on the approved conceptual alignment plan, preliminary engineering details, proposed structural configuration, utility requirements, traffic integration provisions and the complete scope of works contemplated for execution of the Elevated Corridor Project from Sirsi Circle to Nayandahalli on Mysuru Road (Length 5.2kms) in Bengaluru city.

The estimate has taken into consideration the quantities and cost implications of all major and incidental components of work including, but not limited to, detailed investigations, utility mapping and shifting, traffic diversion arrangements, geotechnical investigations, design and proof checking, foundations, substructures, superstructures, elevated rotary/interchange structures, second-level carriageway portions, portal frame structures, UHPFRC/UHPC girder systems, casting yard establishment, transportation and launching arrangements, at-grade road works, slip roads, drainage works, footpaths, lighting, traffic safety works, electrical works, road restoration, utility reinstatement, testing, commissioning, maintenance obligations and all associated civil, structural and allied works required for complete execution of the Project.

The Tenderer shall thoroughly study the conceptual drawings, alignment details, traffic conditions, utility constraints, structural requirements, site conditions and complete scope of works before submission of the Bid. Submission of the Bid shall be deemed to indicate that the Tenderer has fully understood the nature and extent of the Project and has included all costs, risks, obligations, temporary works, construction methodologies and associated requirements necessary for successful completion of the Project within the quoted Contract Price.

The successful Contractor shall be responsible for carrying out detailed design, preparation of working drawings, proof checked as per the direction of Engineer –in-charge, obtaining all necessary approvals including GAD approvals from concerned authorities/Railways wherever applicable, establishment of casting yard, execution of all permanent and temporary works, testing, commissioning and maintenance obligations required for complete execution of the Project.

The elevated corridor superstructure generally comprises UHPFRC/UHPC strutted box girders for wider carriageways, UHPFRC U-Girders for standard carriageways, UHPFRC I-Girders for portal frame and special span arrangements, elevated rotary/interchange structures, second-level carriageway portions and associated structural systems as indicated in the conceptual drawings and tender documents.

No variation in structural quantities, structural configuration, span arrangement, dimensions or scope within the approved conceptual plan area shall ordinarily be considered, and the Contractor shall complete the entire scope of work within the quoted Contract Price. However, any additional structural length or extension beyond the approved conceptual plan area specifically instructed by the Employer due to Government-approved requirements shall be dealt with in accordance with the relevant Special Conditions of Contract governing variation provisions.

3.0 Documentation, Instrumentation, etc.

a. All Drawings shall be made in Latest Version of AutoCAD and the Soft Copies on CDs and ten Hard Copies of Prints of all Approved Drawings and "As Built" Drawings shall be supplied by the Contractor to the Employer at Free of Cost as per the Agreed Programme.
b. CDs and ten Hard Copies of all Approved Design Calculations shall be submitted by the Contractor to the Employer at Free of Cost as per Agreed Programme.
c. Five Video CDs of 180 minutes duration each of the Elements covering the Different Phases of Construction from Start to Finish shall be supplied by the Contractor to the Employer at Free of Cost.
d. Three Copies of "Maintenance Manual" describing Access Arrangements, Important Obligatory Precautions from the Point of View of Structural Safety and Procedure for Minor and Major Repairs of each Component of the Elements, Renewals of Finishes and Treatments periodically including Guarantee / Warranty Certificates

shall be supplied by the Contractor to the Employer at Free of Cost.

e. Three Copies of "Quality Assurance Manual" covering Designs and Drawings, Mix Designs, Materials, Testing, Soil and Rock Properties, Statistical Quality Control, etc. shall be prepared by the Contractor and submitted to the Employer at Free of Cost well before Starting the Work.
f. Three Copies of “Safety Manual” covering necessary Safety and Precautions to be adopted by the Contractor as per Requirements and as per Standards during execution of the Work.
g. Three Copies of "Construction Manual" covering Various Aspects of Construction Methods, Difficulties faced and how they are overcome during Execution, etc. shall be supplied by the Contractor to the Employer at Free of Cost at the Time of Finalisation of Work.
h. The Contractor shall install Fixtures and Fastenings provided by the Employer for housing any Instrumentation that may be useful for the Employer at Contractor’s Cost.
i. Fixing Arrangement for Internal and External Lighting shall be approved by the Employer and executed by the Contractor.

4.0 Programme for Submission and Approval of Designs and Drawings

The Programme for submission of Designs and Drawings for the Elevated Corridor Project from Sirsi Circle to Nayandahalli on Mysuru Road is listed below considering that the total Design and Construction Period presently stipulated by B-SMILE/Government Authorities is restricted to Eighteen (18) Months including monsoon period. Accordingly, the Contractor shall plan and execute all design, proof checking, approvals, casting yard establishment and construction activities through parallel and fast-track execution methodology.

Sl No	Details	Time from Date of Award
1	Award of Work	0
2	Submission of Topographic Survey, Utility Mapping, Preliminary Geotechnical Investigation and Inception Report	3 Weeks
3	Submission of Horizontal & Vertical Geometry, Preliminary GADs, Traffic Diversion and Traffic Management Schemes	5 Weeks
4	Submission of Preliminary Structural Design Parameters, Construction Methodology, Casting Yard Layout, Quality Assurance Manual and Safety Manual	6 Weeks
5	Submission of Design and Construction Drawings for Foundations including Pile Foundations and Pile Caps	8 Weeks
6	Submission of Design and Drawings for Piers, Pier Caps, Portal Frames and Substructures	10 Weeks
7	Submission of Design and Drawings for UHPFRC/UHPC Superstructures including U-Girders, Strutted Box Girders, I-Girders, Elevated Rotary and Second-Level Structures	13 Weeks
8	Submission of Design and Drawings for Bearings, Expansion Joints, Deck Works, Drainage, Electrical Works, Utility Integration and Balance Components	13 Weeks
9	Submission of Final Coordinated Good-for-Construction Drawings	14 Weeks
10	Submission of As-Built Drawings, Completion Documents and Maintenance Manuals	Within 4 Weeks after Completion of Work

Accordingly, the Contractor shall deploy adequate design consultants, proof checking coordination teams, multiple construction fronts, machinery, manpower, precasting facilities and parallel execution methodology to achieve completion within the stipulated period.

The Contractor shall also take into account monsoon impacts, dense urban traffic conditions, utility shifting constraints, restricted working space, traffic diversion requirements, railway coordination, elevated rotary/interchange complexity, second-level structural integration and specialized UHPFRC/UHPC construction methodology while planning the execution schedule.

It is clarified that the above stipulated period has been administratively fixed by the Employer/Government Authorities. However, if extension of time becomes necessary due to reasons attributable to the Employer, Government approvals, utility shifting delays, traffic restrictions imposed by statutory authorities, railway permissions, force majeure conditions or other reasons beyond the control of the Contractor, the same shall be considered in accordance with relevant Conditions of Contract.

The Design shall be submitted in sufficient detail and clarity to enable expeditious proof checked as per the direction of Engineer –in-charge. Approval of drawings and designs by the Employer or Proof Consultant shall not relieve the Contractor from responsibility towards structural adequacy, safety, durability and correctness of design.

All redesigns arising due to utility conflicts, site requirements, authority observations or construction methodology modifications shall be carried out by the Contractor without affecting the progress of the Works.

The Contractor's Designer/Consultant shall attend all design review meetings and coordination meetings conducted by the Employer or reviewing agencies without any additional cost.

The Contractor shall submit complete As-Built Drawings, final design records, maintenance manuals and digital documentation within four (4) weeks from completion of the Works. Suitable penalties and withholding provisions may be applied for delay in submission of such completion documents.

4.1 Resource Planning and Deployment of Major Construction Equipment

The Contractor shall plan, mobilize, deploy, operate, and maintain adequate construction plant, machinery, equipment, manpower, casting facilities, erection systems, testing facilities, traffic management arrangements, and all other resources necessary for successful execution and completion of the project within the stipulated contract period of eighteen (18) months.

The project completion period of 18 months has been assessed considering simultaneous execution of piling works, foundations, substructure works, precast/UHPFRC superstructure works, segment casting, transportation, erection and launching activities, utility shifting, traffic management measures, and associated civil works at multiple work fronts. Accordingly, deployment of adequate resources at different locations concurrently shall be the responsibility of the Contractor to achieve the prescribed milestones and completion targets.

For planning of the construction schedule and assessment of the feasibility of completion within 18 months, the Employer has considered deployment of the minimum key and critical equipment that may be required to achieve the target period of 18 month and required to maintain progress or execute works simultaneously at multiple locations, the Contractor shall augment the plant and machinery over and above the minimum specified quantities at no additional cost to the Employer.

5.0 Construction Schedule

The Construction Schedule and the Methodology of Construction shall be so planned that there is Minimum Obstruction to Traffic during Construction and the entire Work can be completed in minimum possible time.

6.0 Site Office

The Contractor shall provide and maintain Furnished Site Office at the Project Location for the Supervisory Staff of the Employer and his approved Representative. It shall have minimum 40 Sqm of Floor Area and shall include all Items like Electric Supply, Electrical Items, Telephones, Lights, Fans and Complete Wiring, Drinking Water Supply and Hygienic Toilet Facilities completed along with Furniture as listed below.

i.	Executive Table (for the Employer)	: 1 No.
ii.	Executive Chair (for the Employer)	: 1 No.
iii.	Table (for Employer's approved Site Representative, Accountant, Head Clerk and Visitors)	: 6 Nos.
iv.	Ordinary Chair Type I (for the Employer, Accountant, Head Clerk and Visitors)	: 3 Nos.
v.	Table (for all other Staff)	: 2 Nos.
vi.	Ordinary Chair Type II (for all other Staff and Visitors)	: 6 Nos.
vii.	Steel Almirah 1980mm X 915mm X 485mm	: 1 No.

viii. Steel Almirah 1270mm X 765mm X 440mm : 1 No.

ix. Racks – 5 Tier 1800mm X 900mm X 375mm made of Slotted Angles and M.S. Sheets : 3 Nos.

x. Ceiling Fans – 1400mm size. Ceiling Fans shall be of Approved Make and Colour : 3 Nos.

xi. Computer with Printer, Scanner
Core 15 – 650 Processor (4M CACHE, 3.20 GHZ) with 4GB DDR3 RAM, Hard Disc Capacity 500 GB, 22X DVD Writer, 17" size TFT Colour Monitor, HP / Laser Printer of 80 Columns, 104 Keyboard, Optical Mouse with Mouse Pad and HP Scanner along with Broad Band Connection : 2 Nos.

xii. Photo Copier : 1 No.

7.0 Field Laboratory

The Contractor shall establish, operate and maintain adequately equipped Field Laboratories for quality control, testing and monitoring of all materials and works related to the Elevated Corridor Project, including UHPFRC/UHPC works, pile foundations, substructure works, superstructure works, road works and allied civil works.

The laboratory facilities shall be either NABL Accredited or associated with an NABL Accredited Testing Laboratory/Firm for conducting mandatory quality control tests as per relevant IRC, IS, MoRT&H and approved technical specifications. The Contractor shall submit documentary proof of such accreditation/association before commencement of works.

The Contractor shall provide a suitably sized and fully functional site laboratory of adequate area with separate arrangements for concrete testing, aggregate testing, soil testing, steel testing, UHPFRC/UHPC quality evaluation, curing arrangements, storage, calibration and record maintenance. The laboratory shall be established at the casting yard/site office or at suitable approved locations as directed by the Employer/Engineer-in-Charge.

The laboratory shall be provided with all necessary infrastructure and amenities including water supply, uninterrupted power supply, air-conditioned testing rooms wherever required, lighting, internet connectivity, storage racks, curing tanks, work tables, safety arrangements and qualified laboratory personnel.

The Contractor shall provide all required testing equipment, instruments, gauges, moulds, calibration equipment and accessories necessary for routine and specialized testing of materials and works in accordance with relevant IRC/IS/MoRT&H specifications and approved Quality Assurance Plan. This shall include testing facilities for cement, aggregates, concrete, UHPFRC/UHPC materials, admixtures, reinforcement steel, prestressing materials, soil, bituminous materials, pavement layers and other construction materials used in the Project.

All testing equipment shall be periodically calibrated through approved agencies and proper calibration records shall be maintained throughout the Contract Period.

The Contractor shall maintain complete quality control records, cube test registers, material test reports, calibration certificates, pour cards, inspection reports and other documentation in formats approved by the Employer/Engineer-in-Charge.

The Employer/Third Party Engineer/Proof Consultant shall have unrestricted access to the Field Laboratory, testing records and testing procedures at all times during execution of the Project.

7.1 General

i. Oven – Electricity Operated, Thermostatically Controlled, Range upto 200^0C, Sensitivity 1^0C 1 No.

ii. Plat form balance 300 kg capacity 1 No.

iii. Balance 20 kg Capacity – Self Indicating Type 1 No.

iv. Electronic Balance 5kg Capacity – accuracy 0.5 gm 1 No.

v. Water Bath – Electrically Operated and Thermostatically Controlled with Adjustable Shelves, Sensitivity 10^0C 1 No.

vi. Thermometers 4 Nos. each

a. Mercury – in – Glass Thermometer ranges 0 to 250^0C
b. Mercury – in – Steel Thermometer with 30 cm Stem, ranges up to 300^0C

vii. Glass Wares, Spatulas, Wire Gauzes, Steel Scales, Measuring Tape, Casseroles, Pans, Enameled Trays of Assorted Sizes, Pestle Mortar Porcelain Dishes, Gunny Bags, Plastic Bags, Chemicals, Digging Tools like Pickaxes, Shovels, etc. — As Required

viii. Set of IS Sieves with Lid and Pans 450mm Diameter with Sizes of
63 mm, 53mm, 37.5mm 26.5mm, 13.2mm, 9.5mm 6.7mm and 4.75mm — 1 Set
200 mm Diameter of Sizes 2.36 mm, 2mm, 1.18 mm, 600 micron, 425 micron, 300 micron, 150 micron and 75 micron — 1 Set

ix. Water Testing Kit for pH, SO_3 and Cl — 1 Set

x. First Aid Box — 1 Set

7.2 For Soils and Aggregates

i. Rifle Box — 1 No.

ii. Atterberg's Limits (Liquid and Plastic Limits) Determination Apparatus — 1 Set

iii. Compaction Test Equipment both 2.5 kg and 4.5 kg Rammers (Light and Heavy Compact Efforts) — 1 Set

iv. Dry Bulk Density Test Apparatus (Sand Pouring Cylinder, Tray, Can, etc.) complete — 1 Set

v. Speedy Moisture Meter complete with Chemicals — 1 Set

vi. Posthole Auger with Extensions — 1 Set

vii. Core Cutter Apparatus complete with Dolly, Rammer, etc. — 1 Set

viii. Flakiness and Elongation Test Gauges — 1 Set

ix. Standard Measures of 30, 15 and 3 litres Capacity along with Standard Tamping Rod — 1 Set

7.3 For Cement and Cement Concrete

i. Slump Test Apparatus — 1 Set

ii. Compression and Flexural Strength Testing Machine of 200T Capacity with Additional Diameter for Flexural Testing — 1 Set

iii. Cube Moulds for Concrete Tests — 40 Nos.

iv. Surface Moisture and Density Meter for Soil, Aggregate and Concrete — 1 No.

8.0 Casting Yard

The Contractor shall make his own arrangements for identification, procurement/lease, development, establishment, operation and maintenance of suitable Casting Yard(s) required for execution of the Elevated Corridor Project including production of UHPFRC/UHPC girders, precast segments, precast components, trial casting, storage, curing, prestressing operations and associated construction activities.

The Casting Yard shall include all necessary infrastructure such as batching plants, casting beds, mould systems, stressing arrangements, curing systems including steam/controlled curing arrangements wherever required, laboratory facilities, storage areas, launching and handling arrangements, internal roads, drainage, power supply, water supply, safety arrangements, labour facilities and quality control systems complete in all respects.

The Contractor shall obtain all required approvals, permissions, environmental clearances, traffic permissions and statutory compliances required for establishment and operation of the Casting Yard at his own cost.

The location, layout and operational methodology of the Casting Yard shall be submitted to the Employer/Engineer-in-Charge for review prior to commencement of casting activities.

The Contractor shall also ensure uninterrupted production, storage, transportation and handling arrangements for UHPFRC/UHPC girders and precast components to suit the approved construction schedule and project completion requirements.

The quoted Contract Price shall be deemed to include all costs towards establishment, land arrangement, development, operation, maintenance, shifting, restoration and dismantling of Casting Yard(s), including all

temporary and permanent facilities associated therewith, and no separate payment shall be made on this account.

9.0 Disputes

In case of Disputes arising between the Contractor and the Authority approving the Designs, the matter may be referred to the Managing Director (B-SMILE),. The Decision of the Managing Director (B-SMILE) shall be Final and Binding on the Contractor.

10.0 Defect Liability cum Maintenance Period

The Defect Liability cum Maintenance Period for the Project shall be Ten (10) Years from the Date of Completion of the Works and Opening of the Project Corridor to Traffic, unless otherwise specified by the Employer. The Contractor shall remain fully responsible during this entire period for rectification of defects, preventive maintenance, routine maintenance, periodic maintenance, structural performance, durability, riding quality, safety and serviceability of all Works executed under the Contract.

The Maintenance obligations during the Defect Liability cum Maintenance Period shall comprise routine, preventive and periodic maintenance activities necessary for ensuring continued structural safety, riding quality, durability, serviceability and uninterrupted safe operation of the Elevated Corridor Project.

The maintenance obligations shall include inspection, upkeep, repair, rectification and preventive maintenance of elevated corridor structures, UHPFRC/UHPC superstructures, portal frame structures, bearings, expansion joints, crash barriers, wearing course, drainage arrangements, utility corridors, lighting systems, road furniture, painting systems, structural components, footpaths, medians, retaining structures, parapets, road markings, signage and all associated civil, structural and utility works within the Project limits.

The Contractor shall ensure safe and uninterrupted movement of traffic during the entire Defect Liability cum Maintenance Period and shall promptly attend to all defects, damages, leakages, settlements, riding discomfort, structural distress, deterioration, joint failures, potholes, surface wear, drainage blockages, corrosion, utility failures or any safety-related deficiencies observed by the Employer/Engineer-in-Charge.

Maintenance operations shall include regular inspection, cleaning and upkeep of drainage systems, bearings, expansion joints, utility ducts, scuppers, rainwater disposal arrangements and all water conveyance systems, particularly before and during monsoon periods. Areas around bearings, joints and drainage outlets shall be maintained free from debris, dust, oil, grease and stagnant water.

Protective coatings, anti-carbonation coatings, exposed steel components, lighting poles, metallic fixtures, railings, parapets and crash barriers shall be periodically inspected and maintained to prevent corrosion and deterioration. Damaged road markings, signage, reflectors, lighting fixtures, safety furniture and utility covers shall be repaired or replaced immediately whenever required.

Preventive maintenance of UHPFRC/UHPC structural elements, prestressed concrete components, elevated rotary systems, portal frame structures, second-level carriageways, ramps, slip roads and associated elevated structures shall be carried out in accordance with approved maintenance manuals, IRC/MoRT&H Specifications, relevant BIS Codes and manufacturer recommendations wherever applicable.

Routine maintenance of at-grade roads, reconstructed pavements, slip roads, drainage systems, utility restoration stretches, footpaths, utility corridors and all ancillary works executed under the Contract within the Project limits shall also form part of the Contractor's obligations during the Defect Liability cum Maintenance Period.

The maintenance obligations shall not include reconstruction or strengthening necessitated solely due to extraordinary events such as earthquake, major flood, cyclone, sabotage, fire, war, unforeseen natural calamities or damages caused by third-party agencies, unless such damages are attributable to defects in design, workmanship, materials or negligence of the Contractor.

The Contractor shall maintain proper inspection records, maintenance registers, defect rectification reports and periodic condition assessment reports and shall submit the same to the Employer/Engineer-in-Charge as directed from time to time.

The quoted Contract Amount shall be deemed to include all costs towards inspection, defect rectification, preventive maintenance, routine maintenance, periodic maintenance and all obligations during the entire Defect Liability cum Maintenance Period of Ten (10) Years, and no separate payment shall be made on this account